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- **21 or more authors-** Kalnay, E., Kanamitsu, M., Kistler, R., Collins, W., Deaven, D., Gandin, L., Iredell, M., Saha, S., White, G., Woollen, J., Zhu, Y., Chelliah, M., Ebisuzaki, W., Higgins, W., Janowiak, J., Mo, K. C., Ropelewski, C., Wang, J., Leetmaa, A., . . . Joseph, D. (1996). The NCEP /NCAR 40-year reanalysis project. *Bulletin of the American Meteorological Society*, 77(3), 437-471. <http://doi.org/fg6rf9>

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iii <https://www.cancer.gov/publications/patient-education/life-after-treatment.pdf>

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Editorial



reetings to our professional and associate colleagues in academia.

We give God the glory for enabling us to publish the two issues of Volume One of the *Journal of Family and Society Research*. The journal is a publication of the Association for Family and Society Scientists. It is a multidisciplinary medium through which academics and other allied professionals showcase their research output to the world. It offers a credible outlet for all research outputs that border on issues affecting individuals, families and by extension, the wider society.

Journal of Family and Society Research is aimed at publishing articles with quality content and clear methodological procedures. Every article published here undergoes a series of reviews from our able editorial team who have a proven record of academic achievements in their various disciplines.

This Volume 2 publication is remarkable progress in the vision and mission of AFASS. We enjoin you to always attend our very rich and enlightening annual international conferences and workshops. JFSR has both print and online publications.

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Sustainable Management of Family and Societal Resources: Theoretical and Empirical Perspectives

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Abstract

The family unit is the foundation of any society, and therefore it is both the custodian and the beneficiary of society's resources. The three pillars of sustainable family development are social equity, economic viability, and environmental conservation. Bearing on this, the paper reviewed the challenges faced by families in African society such as poverty, political instability, unemployment, insecurity, gender inequality, domestic violence, cultural norms, substance abuse, parent-child conflict, and climate change. It further explored the roles of the family in the sustainable development of society as well as the challenges encountered in the sustainable management of scarce family resources. The paper also provides the way forward and policy recommendations.

Keywords: Sustainable Management, Family Resources, Societal Resources, Challenges, Family Mutuality.

Introduction

I am pleased to be here with you today as the keynote speaker. I have been invited to speak about *Sustainable Management of Family and Societal Resources: Theoretical and Empirical Perspectives*. As a society, we face varied challenges, such as poverty, political instability, unemployment, insecurity, gender inequality, domestic violence, cultural norms, substance abuse, parent-child conflict, climate change, and so forth. These issues impact the sustainability of family and societal resources management. The challenges have led to the decadence of societal resources. The recent Nigerian Presidential election brought a bitter reality in a modern democracy. It taught us that

thuggery, snatching of ballot boxes, violence, destruction of lives and properties, or antisocial behaviours are rewarded. This practice is unacceptable.

Role of Family in Sustainable Development of Societies

The family unit is the foundation of any society; it follows the sustainability mindset model (Tavanti & Davis, 2018). The family unit instils disciplines, values, and responsibilities, such as teaching respect, having a secure and loving environment, loving homes, strong inspiration for education, and rewards for hard work, honesty, and integrity. In addition, the families form an environment of open communication, which in turn builds

trust and teamwork. This model is transitioned to the next generation of leadership within the family tree and society.

Martine and Alves (2015) asserted that the three pillars of sustainable family development are social equity, economic viability, and environmental conservation. According to John Davis (2014), family sustainability consists of the growth of family assets, family unity, and family talent.

Sustainability Challenges Faced by Family

1. Poverty/unemployment is a significant challenge in Nigeria, with many families struggling to meet their basic needs, leading to stress, conflict, and breakdown in family relationships (Muazu & Abdullahi, 2019).
2. According to Anyangwe (2015), gender inequality is still a major challenge in Nigerian families, with women often having limited access to education and economic opportunities. This issue leads to gender-based violence, unequal distribution of household responsibilities, and other forms of discrimination.
3. According to Eke and Ogba (2021), natural disasters, such as soil erosion menace, have caused many communities to face severe life-threatening and exposure to devastating security challenges, which have resulted in armed robbery attacks, kidnapping, raping, Fulani cattle herders attacks, which have left the

victimized communities with little or no ecological interventions from the government.

4. Akinola (2014) established that domestic violence is a significant problem in Nigeria, with many women and children experiencing physical, sexual, and emotional abuse within the family unit. It results in trauma, mental health problems, and long-term negative effects on family relationships.
5. Cultural Norms around gender roles, marriage, and family relationships also challenge Nigerian families. For example, the pressure to conform to traditional gender roles can pressure individuals to conform to societal norms.
6. Substance Abuse, predominantly alcohol and drug abuse, create challenges within Nigerian families and could lead to emotional instability, financial strain, and adverse effects on family relationships.
7. Adejumo (2018) alerted that parent-child conflict arises when there is a clash between traditional and modern values or parents have different expectations for their children, which could cause tension, communication breakdown, and strained family connections.

Family Mutuality- Sustainable Solutions of Family and Societal Resources

The challenges facing families are complex and multifaceted, with various social, economic, cultural, and psychological factors influencing family dynamics and relationships. Overcoming these hurdles requires a concerted effort from individuals, families, communities, and government institutions to promote equality, protect vulnerable individuals, and support healthy family relationships to enable sustainable societal resources.

Because the idea of family has evolved and varies depending on cultural, social, and historical factors, it is characterized by greater flexibility in family structure, gender roles, and parenting practices compared to traditional family models. One aspect of the family is the increasing diversity of family structures.

Family emphasizes positive communication, empathy, and negotiation, which are essential for the growth of their financial assets. These three factors- growth of family assets, family unity, and family talent- are crucial for consistent family success and vital for leading families worldwide. The family units should be recognized as having an essential role in the ecosystems. Because it plays critical roles in society, serving a variety of functions that contribute to the overall well-being of individuals and communities.

The family is responsible for the socialization of children, helping them learn the values, norms, and behaviours of their culture. Children

learn to communicate, cooperate, and relate to others through family interactions and modelling. In addition, families provide economic support to their members, income-earning, or pooling resources. The family provides emotional support and a sense of belonging to its members, creating a secure and supportive environment for their development. The family cares for its members, including children, elderly relatives, and those with disabilities or illnesses. Finally, families are responsible for transmitting cultural traditions, beliefs, and values to future generations, ensuring the continuity of culture and identity.

While there are still challenges and inequalities facing families, the family represents a move towards greater diversity, flexibility, and equality within family relationships.

Ifegbesan (2010) stated the theoretical frameworks, such as the Theory of Reasoned Action (TRA), an individual intention to perform is the immediate determinant of the action, and Planned Behavior (TPB) stipulates that what a person does is determined by personal motivation, which is determined by social support, attitude, and perceived behavioural control. Therefore, families play essential roles in developing and managing societal resources through numerous strategies, including the following:

1. *Responsible consumption*: Families can practice responsible consumption by conserving energy, reducing waste, and choosing eco-friendly products,

- which will help to reduce the family's environmental effects and preserve natural resources for future generations. Recycling: is another vital way to manage societal resources sustainably. Families can recycle plastic, paper, glass, and metal to reduce waste and conserve natural resources around their terrains.
2. *Education and awareness*: Educate families about the importance of managing resources and the impact of their actions on the environment, which will promote a culture of sustainability and encourage responsible behaviour.
 3. *Community Engagement*: Families can participate in community initiatives and programs promoting sustainable practices, such as gardens, helping build community, and promoting a shared responsibility for managing resources.
 4. *Advocacy*: Families can advocate for policies and programs that promote sustainable practices at the local, state, national, and global levels. This approach can include supporting policies that protect the environment, reduce waste, and promote renewable energy.
 5. *Collaboration*: Families can collaborate among themselves, organizations, and businesses to promote sustainability and share resources, including sharing tools and participating in community events that promote sustainable practices.
 6. *Government Involvement*: need to build institutions with strong governance and can provide adequate funding and policy implementation to raise the level of public awareness toward environmental quality, knowledge, and attitude toward nature conservation.
 7. *Adopting technology*: can play an essential role in promoting sustainable management of family and societal resources by leveraging smart technology, such as thermostats, lighting, telecommuting, shared public transportation, and waste management apps to reduce environmental impacts. In addition, the rise of emerging algorithm-driven artificial intelligence (AI), ChatGPT, and similar AI solutions envisaged amplifying human effectiveness and efficiency.
- In summary, the success of sustainable management of family and societal resources depends on the sustainability and development of the intergenerational management process and the drive to make the right decisions and professionalization in the institutionalization process of the management approach.
- I leave you with these quotes:**
 “You never change things by fighting the existing reality. To change something, build a

new model that makes the existing model obsolete"

- Buckminster Fuller.

"It is horrifying that we have to fight our government to save the environment."

- Ansel Adams.

Nevertheless, I say:

"It is horrifying that we have to fight our government to save our votes; however, the only way to contribute to sustainable management of family and societal resources is to cast our votes and stand to defend the transmission of our votes, lest we perish in corruption."

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Availability and the Extent of Utilization of Information Communication Technology among Senior Secondary School Students in Nsukka Local Government Area, Enugu State

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Abstract

The study investigated the availability and the extent of utilization of information communication technology (ICT) among senior secondary school students in Nsukka Local Government Area. The study adopted a descriptive survey research design. Four objectives guided the study. Simple random sampling was used to select a sample of 268 out of 3,467 senior secondary students. A questionnaire was used for data collection. Data were analysed using frequencies, percentages, means, and standard deviation. Findings showed that the majority (80.20%) of the respondents have desktop computers, 71.60%; internet, 71.60%; laptops, 69.80%; smartphones and 79.50% have television available to them. Over 50.00% never use digital cameras, e-book readers and presentation tools. Some of the barriers to ICT usage identified by the respondents were the high cost of new ICT devices and internet data bundles ($\bar{x} = 2.50$), teachers' lack of technological skills ($\bar{x} = 2.51$), school administrators' dismissive attitude towards learning through computers ($\bar{x} = 3.00$), poor electric power supply ($\bar{x} = 2.51$), a large number of students in a class ($\bar{x} = 2.90$), poor internet access ($\bar{x} = 2.59$), substandard quality of existing ICT tools ($\bar{x} = 2.53$) and poor educational funding by the government ($\bar{x} = 3.02$). Some ways of improving the utilization of ICT for studies identified by the respondents were the provision of computer laboratories with versatile ICTs for usage ($\bar{x} = 2.95$) and promoting sharing of knowledge with ICTs among students ($\bar{x} = 2.61$). Therefore, the government should make adequate provisions for ICT facilities and a constant power supply for secondary schools. This will help to increase the use of ICT for academic purposes.

Keywords: Information Communication Technology, School, Availability, Utilization, Students

Introduction

The introduction of Information Communication Technology (ICT) into different areas of man's activities, particularly in schools, has become the most effective step taken to improve teaching and learning methods and promote educational goals. As such, many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing and numeracy (Ratheeswari, 2018). ICT has been described as any equipment or interconnected system of equipment that is used in the automatic acquisition, storage and manipulation of information. ICT comprises electronic devices which are utilized for the information and communication needs of institutions, organizations, students and individuals (Ezeuwa, 2014). It also involves skills around computing and communications devices, software that operates them, applications that run on them, and systems that are built with them (Chen *et al.*, 2015). Modern ICTs have created a global village in which people communicate with others across the world as if they were living next door (Khan *et al.*, 2015). ICT can be defined as a technological means of collecting, processing and transferring information. That is technologies that provide access to information through communications (Ajayi, 2014).

ICTs cover Internet service provision, telecommunications equipment and services, information

technology equipment and services, media and broadcasting, libraries and documentation centres, commercial information providers, and network-based information services, among others (Okoro & Ekpo, 2016). According to Khan *et al.* (2015), ICT encompasses radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. Amuche (2015) listed some examples of ICT tools including computers, laptops, video machines, multi-media projectors or power points, digital cameras, internet facilities, computer networks, telephone (GSM and land phones), e-library, television programmes, databases among others. ICT has now become a global phenomenon and there is a need for nations to embrace it and integrate it into the teaching and learning process.

Integration of ICT in education refers to the incorporation of computer-based communication into the daily classroom instructional process. ICT integration aims to improve and increase the quality, accessibility and cost-efficiency of the delivery of instruction to students (Ghavifekr & Rosdy, 2015). The use of ICTs in the educative process has been divided into two broad categories: ICTs for Education and ICTs in Education. ICTs for education refer to the development of ICT specifically for teaching/learning purposes, while the ICTs in education

involve the adoption of general components of ICTs in the teaching and learning process (Hussain et al., 2017). ICTs have the potential to innovate, accelerate, enrich, and deepen skills, motivate and engage students, help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change. ICTs are generally accepted as a modern educational instrument that enables educators to modify their teaching methods to increase students' academic performance (Okoro & Ekpo, 2016). A study by Selwyn (2004) showed that to improve students' achievement, it is not enough for schools to provide access to ICT; they must also provide real opportunities to use the technologies as well as adequate quality of access.

Numerous studies have shown the benefits of ICT in the teaching and learning process in the last few decades. For example, effective use of technology has been found to enable students to become active learners while also developing their problem-solving, critical thinking, and creativity skills. Furthermore, ICT provides students and teachers with more flexible and extensive access to information and learning materials. It can provide students with the abilities they need to be lifelong learners and global citizens in the twenty-first century (Ghavifekr & Rosdy, 2015). It encourages learning; motivates the individual and at the same time gives him/her the capability to do certain activities.

Besides that, its presence betters the learning environment and enriches the learning experience (Markovac & Rogulja, 2009). It also lays the foundation for lifelong learning and personal development, because among other things it also develops the digital and technical competencies, which are needed for employment, education, self-development, and general activeness in modern society (Mewcha & Ayele, 2015). The introduction of ICTs in schools will not change students' outcomes alone without the support and manipulation of teachers who are capable of exploiting the possibilities of ICT in the teaching and learning process (Ikwuanusi et al., 2016).

ICT provides a variety of tools to support and facilitate teachers' professional competence. It can contribute to universal access to education, equality in instruction, quality in teaching and learning and the professional development of teachers, as well as to more efficient management and administration of education systems (West & Chew, 2014). ICT transforms teaching and helps teachers to be more efficient and effective, thereby increasing their interest in teaching. It increases teachers' emphasis on individualized instruction, and as such enables them to spend more time with individual students. This helps students to carry out more independent work and gives the teacher more time to focus on teaching higher-level concepts in the classroom (Ikwuanusi et al., 2016). The implication is that teachers should upgrade, appreciate and develop a positive attitude towards

the application of ICT in the teaching and learning process.

A general decline in the performance of students has been reported by researchers and educationists. According to Duruji et al. (2014), the poor performance of secondary school students in different subjects as observed in the yearly results of the Senior School Certificate Examination conducted by WAEC and NECO which are external bodies justifies the claim of dwindling academic performance of students in Nigeria. Educators and librarians have blamed “progressive education” and technological evolution for taking away students’ attention from reading to other digital media and ICT tools. However, Aina (2013) argued that the benefits of ICT could be exploited and integrated into the teaching and learning processes to increase students' interest in learning and, as a result, improve their academic performance. A study conducted by Hue and Ab-Jalil (2013), showed that the integration of ICTs into the curriculum is a crucial process in ensuring the quality of education and increased students’ academic performance. Nevertheless, implementation of these findings in Nigeria has been recorded to be difficult if not impossible. For instance, a study by Nnamani et al. (2019) revealed that only three ICT resources were available for teaching the English language in secondary schools in Nsukka Urban. The study also revealed that the very few that were available were grossly underutilized. Another study by Olelewe and Nzeadibe (2014) also

showed that there is a gross shortage of computer teachers and inadequacy of ICT resources which affected the quality of education given to students in post-primary schools in Nsukka Educational Zone of Nigeria. This has been attributed to unsatisfactory conditions of secondary schools in Nsukka local government area in the form of large class sizes; poorly equipped laboratories and libraries; unavailability of instructional materials; poorly maintained buildings and unavailability of qualified teachers (Enujuba, 2019). Although many educational institutions have embraced digital solutions by using smart devices in classrooms and creating online communities (Shankar, 2018), the effective inclusion of these technologies into teaching practice has encountered and continues to encounter practical and pedagogical barriers. According to Ikwuanusi et al. (2016), effective utilization of ICT in teaching and learning depends on the availability of these facilities and teachers' competence in using them. This study, therefore, determined the availability and the extent of utilization of ICT by students in senior secondary schools in Nsukka local government area.

Objectives of the Study

The broad objective of the study was to investigate the availability and extent of utilization of ICT among senior secondary school students in Nsukka Local Government Area, Enugu State. Specifically, the study determined:

1. various types of ICT available to senior secondary school students in Nsukka L.G.A;
2. the extent to which students utilize the available ICTs for their studies;
3. barriers to the use of ICT in secondary schools in Nsukka L.G.A; and
4. ways students' utilization of ICT for their studies could be improved.

Methodology

Study design: The study employed a descriptive survey research design. This design allowed for the study of population variables at one specific time.

Study population: The population of this study was 3,467 Senior Secondary (SS) two students in the 31 government secondary schools in Nsukka L.G.A. (Post Primary School Management Board – PPSMB, Nsukka Zonal office, 2018). The students were mostly aged between 15-17 years old and more than half of them were females.

Sample for the Study: Sampling was done using a multi-stage sampling technique. Firstly, six schools, which represent twenty per cent of the 31 schools, were selected from the list of schools using systematic random sampling. Secondly, to determine the sample size, thirty per cent of all SS 2 students in each of the six schools was selected and this gave a sample size of 268. Finally, the samples for each school were selected using simple random sampling without replacement.

Instruments for Data Collection: The instrument used to elicit information

from the respondents on the objectives of the study was a questionnaire developed by the researchers after an extensive literature review. The questionnaire consisted of five sections; A to E. Section A contained background information of the respondents; B obtained data on the availability of ICT devices; Section C elicited data on the extent of utilization of ICT for academic purposes; Section D was used to elicit information on barriers to the use of ICT for academic purposes and section E was used to obtain data on different ways of improving students' utilization of ICT for their studies. The instrument was content and face validated by three experts from the Department of Home Science and Management, University of Nigeria, Nsukka. Cronbach's alpha reliability method was employed to obtain a reliability coefficient of 0.87 for the instrument, indicating a high internal consistency of the items.

Method of Data Collection: Two hundred and sixty-eight (268) copies of the questionnaire were hand administered to students with the help of research assistants. The respondents filled out the questionnaires immediately with little or no assistance. All the questionnaires were distributed and retrieved, giving a 100% return rate.

Method of Data Analysis: The results were analysed using frequencies, percentages, means and standard deviations. Frequency and percentage were used to present results on the respondents' background information, availability

and extent of utilization of ICT. Mean and standard deviation was calculated for barriers to ICT usage and ways of improving students' utilization of ICT for their studies. Underutilization of ICT facilities, any item that had up to 50% of regular and occasional use was accepted as highly utilised while below 50% was accepted as low utilisation. For items on the four-point scale, means of 2.50 and above were regarded as agreed while means of less than 2.50 were regarded as disagreed.

Results

Background information of the respondents

Data analysis on the background information of the respondents shows that 53.70% of the respondents were females while 46.30% of them were males. The majority (64.20%) of the respondents were aged between 15-17 years. A good proportion (44.40%)

of the respondents had their family monthly income between ₦10,000-50,000; 40.30% of their fathers and 42.50% of their mothers had obtained tertiary education qualifications. More than a third (38.40%) of the respondents' fathers and 36.20% of mothers were civil servants.

Availability of ICT for Senior Secondary School Students in Nsukka LGA

Table 1 shows the frequency and percentage of responses on types of ICT available to the students. Over 50% of the respondents had the following ICT tools available to them; desktop (80.20%), internet facility (71.60%), laptop (71.60%), tablet (56.70%), projector (56.00%), radio (65.70%), storage devices (67.20%), gaming devices (57.80%), smartphone (69.80%) and television (79.50%).

Table 1: Availability of ICT for Senior Secondary School Students in Nsukka LGA

ICTs	Available F (%)	Not available F (%)
Desktop computer	215 (80.20)	53 (19.80)
Internet	192 (71.60)	76 (28.40)
Tablet	152 (56.70)	116 (43.30)
Laptop	192 (71.60)	76 (28.40)
Smartphone	187 (69.80)	81 (30.20)
Digital camera	124 (46.30)	144 (53.70)
E-book reader	130 (48.50)	138 (51.50)
Interactive whiteboard	151 (56.30)	117 (43.70)
Television	213 (79.50)	55 (20.50)
Presentation tools such as PowerPoint	120 (44.80)	148 (55.20)
Projector	150 (56.00)	118 (44.00)
Radio	176 (65.70)	92 (34.30)
Storage devices e.g. memory cards, CDs, flash drive	180 (67.20)	88 (32.80)
Gaming devices	155 (57.80)	113 (42.20)

Key: F = frequency, % = percentage, N = 268

The extent of utilization of ICT by Senior Secondary School Students in Nsukka L.G.A

Table 2 shows the frequency and percentage responses on the extent of utilization of ICTs. ICT facilities that were highly utilised by the respondents included desktop computers (50% always used and 30.2% sometimes used), internet (38.1% always used and 33.6% sometimes used), tablet (34.3% always used and 22.4% sometimes used), laptop (45.1% always used and

26.5% sometimes used), smartphone (31.3% always used and 38.4% sometimes used), television (31% always used and 48.5% sometimes used) and gaming devices (31.7% always used and 26.1% sometimes used) among others, while the digital camera (25.4% always used and 20.9% sometimes used), e-book reader (31% always used and 17.5% sometimes used) and presentation tools (30.6% always used and 14.2% sometimes used) had low utilisation.

Table 2: Frequency and percentage responses of students on the extent of utilization of ICT

ICT	Always F (%)	Sometimes F (%)	Never F (%)	Utilization level
Desktop computer	134 (50.00)	81 (30.20)	53 (19.80)	High
Internet	102 (38.10)	90 (33.60)	76 (28.40)	High
Tablet	92 (34.30)	60 (22.40)	116 (43.30)	High
Laptop	121 (45.10)	71 (26.50)	76 (28.40)	High
Smartphone	84 (31.30)	103 (38.40)	81 (30.20)	High
Interactive whiteboard	60 (22.40)	91 (34.00)	117 (43.70)	High
Television	83 (31.00)	130 (48.50)	55 (20.50)	High
Projector	103 (38.40)	47 (17.50)	118 (44.00)	High
Radio	65 (24.30)	111 (41.40)	92 (34.30)	High
Storage devices (memory card, CDs, flash drive)	149 (55.60)	31 (11.60)	88 (32.80)	High
Gaming devices	85 (31.70)	70 (26.10)	113 (42.20)	High
Digital camera	68 (25.40)	56 (20.90)	144 (53.70)	Low
E-book reader	83 (31.00)	47 (17.50)	138 (51.50)	Low
Presentation tools such as PowerPoint	82 (30.60)	38 (14.20)	148 (55.20)	Low

Key: F = frequency, % = percentage, N = 268

Barriers associated with the use of ICT for secondary students in Nsukka L.G.A

Table 3 shows the barriers to ICT usage in teaching and learning. From the table, the respondents agreed on the following student-related barriers to ICT usage; poor access to ICT

devices (2.88), lack of training on the use of some of the devices (2.79) and high cost of new ICT devices and internet data bundles (2.50). Teacher-related barriers include lack of confidence and skills for using the technologies (2.51), disbelief and distrust of ICT benefits (2.60), lack of

<p>training and experience on how to effectively integrate technology into the teaching and learning process (2.58) and no time to successfully integrate the technologies in the curriculum (3.05). School administrator-related barriers are a lack of technical staff to solve technological problems (2.93), the problem of dismissive attitude towards learning through computers (3.00), insufficient technological and administrative support for teachers to use ICT devices (2.62) and the school as an institution provides teachers with little or no time to learn about ICT skills (2.56). Environment-related barriers include a poor electric power supply (2.51), poor school space organization (2.53), a large number of students in a class (2.90), the physical condition of classes not suitable for technology integration (2.53) and</p>	<p>classes are very crowded making use of the ICT difficult (2.73). Infrastructure-related barriers include the insufficient number of technological devices in the classroom for students' use (2.53), poor internet access in the form of slow internet connectivity (2.59), lack of required ICT infrastructure and digital learning resources (2.66), malfunctioning of computers in need of repairs (2.62), lack of computer software adaptable to the curriculum (2.56), substandard quality of existing ICT tools (2.53) and outdated ICT equipment that needs replacement (2.79). Government-related barriers are poor educational funding by the government (3.02), unfavourable government policies (2.86), inflexible regulatory environment (2.65) and lack of centralised ICT support from the government (2.84).</p>
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Table 3: Mean and standard deviation responses of students on the barriers to ICT usage for teaching and learning

Barriers	Mean	SD	Remark
Student-related barriers			
Lack of required ICT skills	2.31	1.185	Disagree
Poor attention to classes when using technology	2.34	1.167	Disagree
Poor access to ICT devices	2.88	1.26	Agree
Lack of training on the use of some ICT devices	2.79	1.32	Agree
High cost of new ICT devices and internet data bundles	2.50	1.19	Agree
Inexperience with ICT learning tools	2.14	1.36	Disagree
Teacher-related barriers			
Lack of confidence and skills for using the technologies	2.51	1.101	Agree
Poor awareness of ICT benefits	2.60	1.352	Agree
Lack of training and experience on how to effectively integrate technology into the teaching and learning process	2.58	1.145	Agree
No time to successfully integrate the technologies into the curriculum	3.05	1.361	Agree
Technology integration limits the role of teachers in the classroom	2.40	0.977	Disagree

The use of technology negatively affects the quality of instruction	2.39	1.095	Disagree
Classroom management is more difficult when ICT is in use	2.37	1.119	Disagree
School administration-related barriers			
Lack of technical staff to solve technological problems	2.93	1.211	Agree
Problem of dismissive attitude towards learning through computers	3.00	1.502	Agree
Difficulty integrating ICT into the school curriculum	2.32	1.140	Disagree
Difficulty organising school/lesson time when ICT is in use	1.72	0.869	Disagree
Insufficient technological and administrative support for teachers to use ICT devices	2.62	1.181	Agree
The school as an institution provides teachers with little time to learn about ICT skills	2.56	1.246	Agree
Environment-related barriers			
Poor electric power supply	2.51	1.123	Agree
Poor school space organization	2.53	1.114	Agree
Large number of students in a class	2.90	0.974	Agree
Physical condition of classes is not suitable for technology integration	2.53	1.345	Agree
Classes are very crowded making use of the devices difficult	2.73	1.284	Agree
Infrastructure-related barriers			
Insufficient number of technological devices in the classroom for students' use	2.53	1.210	Agree
Poor internet access in the form of slow internet connectivity	2.59	1.164	Agree
Lack of required ICT infrastructure and digital learning resources	2.66	1.183	Agree
Malfunctioning computers in need of repairs	2.62	1.187	Agree
Lack of computer software adaptable to the curriculum	2.56	1.243	Agree
Substandard quality of existing ICT tools	2.53	1.347	Agree
Outdated ICT equipment that needs replacement	2.79	1.001	Agree
Government-related barriers			
Poor educational funding by the government	3.02	1.186	Agree
Unfavourable government policies	2.86	1.255	Agree
Inflexible regulatory environment	2.65	1.229	Agree
Lack of centralised ICT support from the government	2.84	1.363	Agree

Key: SD = Standard Deviation

Ways of Improving Students' Utilization of ICT for Their Studies
Table 4 shows the mean and standard deviation responses of students on

ways of improving students' utilization of ICT for their studies. Findings showed that the respondents agreed to all the items as ways of improving students' utilization of ICT for their studies. Some of the ways include delivering lessons through the use of internet-based learning activities (3.05), expanding access to learning to take

place at all times and locations with ICT tools (3.00), provision of computer laboratories with versatile ICTs for usage (2.95), accepting the fact that inclusion of technology can increase efficiency and effectiveness of learning (2.81), and promoting and encouraging sharing of knowledge with ICTs among students (2.61).

Table 4: Mean and standard deviation responses of students on ways of improving students' utilization of ICT for their studies

Variables	Mean	SD	Remark
Enrichment of the curriculum to incorporate ICT contents	2.79	1.724	Agree
Delivering lessons through the use of internet-based learning activities	3.05	0.841	Agree
Acceptance of the flexibility of ICTs in teaching and learning	2.51	1.822	Agree
Accepting the fact that the inclusion of technology can increase the efficiency and effectiveness of learning	2.81	1.883	Agree
Provision of computer laboratories with versatile ICTs for usage	2.95	1.679	Agree
Professional development of teachers on quality use of ICTs	2.54	1.015	Agree
Expanding access to learning to take place at all times and locations with ICT tools	3.00	0.836	Agree
Enhancing teachers-learners contact with ICT resources	2.53	1.882	Agree
Maintaining continuous education for teachers to be current with the use of ICTs	2.51	1.857	Agree
Promoting and encouraging sharing of knowledge with ICTs among students	2.61	1.127	Agree

Key: SD = Standard Deviation; **Rmk** = Remark

Discussion

The availability of learning resources has a considerable impact on teaching and learning. Availability of ICT facilities refers to the provision made in this regard by and or to the secondary schools for effective teaching and learning (Ezeuwa, 2014). Findings showed that the types of ICT available to students were desktop computers, the internet, laptops, smartphones and televisions. The

availability of these facilities was attributed to the wide range of functions they offer, especially their use for academic purposes. This finding is in line with that of Ayeni and Ogunbameru (2013) which shows that computer sets, bulletin boards, phones, printer scanners and the internet were available in secondary schools in Ondo State. Similarly, Ajeigbe et al. (2015) reported the availability of

computers, printers and laptops in secondary schools in Osun State. A study by Ezeuwa (2014) in Ebonyi State public secondary school showed the availability of ICT facilities such as computers, cell phones, electronic whiteboards, cable satellites, overhead projectors and storage devices. Findings also showed that digital cameras, e-book readers and presentation tools were not available to most of the respondents. This was attributed to the high cost of these devices resulting in the students' inability to acquire and use them for academic purposes. However, there is an indication that the devices are gradually gaining popularity among students. Supporting this finding, Ikwuanusi et al. (2016) reported that smart boards, computer software, projectors, camera, e-library and cable networks were not available in secondary schools in Owerri Municipal Council of Imo State.

Utilization of ICT facilities is as important as making them available, however, the availability of the facilities may not be a guarantee for their proper utilization (Ezeuwa, 2014). This notwithstanding, the findings of this study showed a high utilization of a good number of the ICT tools such as tablets, the internet, radio, gaming devices, laptops, television, smartphone and storage devices among others. These ICT tools provide and allow students to have swift and direct access to a wide variety of information and educational resources (Computeam Climate Project, 2023). Supporting the findings, a study by Al-Hariri and Al-Hattami (2016) showed that laptops,

phones, tablets and desktop computers were the most used technological devices by the participants. In contrast, a study by Ezeuwa (2014) showed low utilization of ICT facilities such as the internet, e-mail, fax, video conferencing, cable satellite, electronic whiteboard, radio cassette recorders, overhead projectors, flash drives, diskettes and CD ROM. Obuezie et al. (2018) reported that Information Communication tools are being increasingly utilized by students in Nigeria because it enables them to have access to timely, accurate and relevant materials. The internet, for instance, provides links to various library sites, specializing in almost every topic and they can be accessed directly from any part of the world. Nasir et al. (2011) indicated that ICT is very essential to improve the educational efficiency of students because they are helpful for the students to better prepare their assignments and projects. Findings also showed low utilization of digital cameras, presentation tools and e-book readers. This was attributed to the fact that these advanced ICT facilities are still not very popular in many developing countries like Nigeria, thereby limiting their use (Almarabeh *et al.*, 2005; Kpangban & Adomi, 2010). According to Hailegebreal et al. (2022), the use of educational technologies in teaching and learning activities is still in its infancy in most African countries.

The barriers to ICT usage are those factors that hinder the effective and efficient adoption of ICT in the teaching and learning process. From

the result of the findings on barriers to ICT usage, poor access to ICT devices, lack of ICT training, high cost, lack of time, poor electric power supply, insufficient number of technological devices for students, poor internet connectivity, substandard quality of ICT tools and poor educational funding were identified as barriers to ICT usage. A similar finding by Onodugo (2016) identified the poor implementation of policies on ICT, the problem of connectivity, the non-reliability of public electricity, inadequate funding of ICT infrastructure and poor maintenance of available facilities. In Nigeria, most academic institutions are yet to fully harness these technologies for better delivery of materials in the teaching and learning process; and lack of funds has been identified to be at the root of these problems according to Obuezie *et al.* (2018). The result of this study is in agreement with the position of Damkor *et al.* (2015) concerning the lack of ICT tools and electricity in teaching and learning. Ezeji *et al.* (2015), also pointed out that the major challenge that affects students in the use of internet resources is inadequate power supply. For instance, one may be in the middle of an important work and suddenly there is a power outage which results in wasted efforts, time and frustration may set in. Furthermore, the lack of training staff in the use of computers and associated technologies was identified by Onuoha (2013) as a challenge that hinders the effective delivery of school materials through the use of ICT. These barriers inhibit

the successful integration of ICT in teaching and learning environments.

Information and communication technology is an indispensable tool for attaining the objective of rapid national development in the world; hence, ICT tools in instructional delivery have positively and maximally influenced the field of education. Findings on ways of improving students' utilization of ICT for their studies showed the use of internet-based learning activities, provision of computer laboratories and encouraging students to share knowledge using ICT tools. According to Idele and Paul-Mgbeafulike (2018), some strategies for improving the quality use of ICT tools include acceptance of the belief that system that technology can improve the efficiency and effectiveness of student learning, curriculum enrichment to incorporate ICTs instructional contents, Internet-based instructional delivery of the curriculum content that is enriched with the environment for learning, acceptance of the flexibility of ICTs in teaching and learning, professional development of teachers on quality use of ICTs, enhancing teachers-learners contact with the ICT resources, maintaining continuous education for the teachers to be current with quality use of ICTs and create just-in-time training for the teachers on the emergence of new technologies. Oluoch (2016) also suggested organizing workshops on IT and educating the staff on the importance of ICT in the learning process, looking for grants from the government to buy computers,

seeking ICT grants from NGOs and using parents' contributions for buying computers.

Conclusion

The study investigated the availability and utilization of information communication technology by senior secondary school students in Nsukka local government area. The study established the availability of ICTs such as desktop computers, the internet, laptop, smartphone and television for the students. High utilization of the majority of the ICT facilities was also indicating that secondary school students in Nsukka local government area have adequate access to, and are taking advantage of various ICT devices. However, they face several barriers to the optimal use of ICT such as the high cost of new ICT devices and internet data bundles, teachers' lack of technological skills, school administrators' dismissive attitude towards learning through computers, poor electric power supply, a large number of students in a class, poor internet access, substandard quality of existing ICT tools and poor educational funding by the government. Students' utilization of ICT for their studies can be improved through the provision of computer laboratories and by encouraging students to share knowledge using ICTs.

Recommendations

Based on the findings of the study, to improve the integration of ICT in the teaching and learning process, the

following recommendations were made.

1. ICT tools and funds for maintaining them should be provided to schools by the federal and state government.
2. Constant power supply and internet access should be provided in secondary schools to maximize the use of ICT for academic purposes.
3. Training, workshops, seminars and conferences should be organized for teachers on ICT skills so that they will keep improving their knowledge of ICT and its usage and effectively apply it in the teaching and learning process.
4. Government should look into improving teachers' remuneration and creating an environment that will motivate them to acquire ICT skills and utilize them in the teaching and learning process.

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Assessing Parenting Styles, Self-Esteem and Self-Disclosure of Adolescents in Nsukka Urban, Enugu State

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Abstract

The major purpose of the study was to assess the parenting styles, self-esteem and self-disclosure of adolescents in Nsukka Urban. Five specific objectives guided the study. A cross-sectional survey research design was adopted for the study. The population for the study consisted of all the SSI and SSII students in 15 government secondary schools in Nsukka urban. The sample size was 344 SSI and SSII students in nine secondary schools in Nsukka Urban. A modified standardized questionnaire was used for data collection. Cronbach Alfa reliability co-efficient of 0.80 was obtained for the instrument. The data from the questionnaire were coded and input into the Statistical Product and Service Solution (IBM-SPSS, version 23.0). Descriptive results were presented in frequencies, percentages mean and standard deviations. Findings revealed that the authoritative parenting style was more prevalent (52.00%) among the participants. The majority (89.20%) of the adolescents had high self-esteem. Respondents with high levels of self-disclosure were 78.80%. The study concludes that adolescents in the study area had a relatively high level of self-esteem and a high level of self-disclosure. Authoritative parenting style was more prevalent in the area. The study recommends that more research should be conducted in other parts of the state and Nigeria to provide national data on prevalent parenting styles used on adolescents and the levels of self-esteem and self-disclosure of adolescents.

Keywords: Parenting style, adolescent, self-esteem, self-disclosure

Introduction

Adolescence is the most important period of life where growth and development are accompanied by various physical, physiological, behavioural and social changes. It is the period in life when an individual is no longer a child, but not yet an adult. According to World Health Organization [WHO] (2015), adolescence refers to the transitional phase of growth and development between late childhood and adulthood while an adolescent is any person between the ages of 10 and 19 years. Adolescence is usually associated with the teenage years, but its physical, psychological or cultural expressions may begin earlier and end later. It is widely accepted that adolescence is a time of transition involving multidimensional changes: biological, psychological, cognitive and social changes (Steinberg, 2002). One of the most important functions of the adolescence stage is to discover one's identity and view of life, without inner conflict and the need to always act within acceptable moral standards, abide by parental authority, or meet peer expectations (Karacic & Oreskovic, 2017). The individual's capacity for abstract and critical thought also develops, along with a sense of self-awareness when social expectations require emotional maturity. Adolescents build their self-esteem at this stage of their life.

Self-esteem is an individual's subjective evaluation of their worth. It

encompasses beliefs about oneself as well as emotional states, such as triumph, despair, pride, and shame. According to Smith and Mackie (2007), self-concept is what people think about the self; and self-esteem is the positive or negative evaluations of the self, and how they feel about it. Self-esteem is a major key to success in life. This social dominance simply means that adolescents on the middle level on the self-esteem scale are comprised of varied personality characteristics, some of which can be more positive than others (McLeod & Uemura, 2012). Self-esteem can be high or low. High self-esteem simply means that the individual respects himself, and considers himself worthy. Low self-esteem, on the other hand, implies self-rejection, self-dissatisfaction, and self-contempt.

An individual faces many problems during the adolescence stage and many times it becomes very difficult to maintain an optimal level of self-esteem. With globalization, the concept of personal space is expanding very fast and teenagers usually demand personal space for themselves. Their relative immaturity, heightened emotionality, and eagerness to become independent may take them on the wrong path and lead to devastating results, such as cybercrimes, drug addiction, risky sexual behaviours and low self-esteem (Orth & Robins, 2014). It is the role of parents to provide their children with enough physical and psychological space so that they can

grow and form their own identity. However, this is a challenging task for parents due to their need to always monitor and supervise their children (Orth & Robins, 2014). Parents should keep an eye on their teenagers without making them feel like their intelligence and abilities are being questioned. Children's self-disclosure, self-confidence, and self-esteem can all be damaged as well as the trust between parents and children if they even have the tiniest inkling that what they do are being scrutinized and doubted by their parents. The nature of the relationships adolescents have with each of their parents has a significant impact on how they develop and adjust. Any adolescent's level of self-esteem is influenced by the standard of care they receive, the environment in which they live, and the parenting style their parents apply (Orth et al., 2014). This implies that the styles parents employ in raising their children affect their self-esteem.

Parenting is the process or the state of being a parent and parenting style is a psychological construct representing standard strategies that parents use in their child-rearing process. Parenting styles are the representation of how parents respond and demand from their children. It is significantly related to a child's subsequent mental health and well-being. Parenting style provides a robust indicator of parenting functioning that predicts child well-being across a wide spectrum of environments. Parental

responsiveness and parental demandingness are important components of good parenting. Parenting style usually is conceptualized along two dimensions: parental demandingness (control) and parental responsiveness (warmth), which can be combined to create four categories of parenting: authoritative (high demandingness and high responsiveness), authoritarian (high demandingness, and low responsiveness), indulgent or permissive (low demandingness and low responsiveness), and indifferent or neglecting (low demandingness and low responsiveness). Parenting is a dynamic process not a fixed state therefore it needs continuous assessment of the child's needs, abilities and situational demands. Parental support is crucial in adolescence and parents could promote self-esteem in their children and reduce psychological distress by offering their support throughout this developmental phase (Boudreault-Bouchard et al., 2013). The type of parenting style adopted by parents could be a factor in the self-disclosing ability of their children.

Self-disclosure is the process of passing on information about oneself to someone else - intentionally or unintentionally. The details can range from the superficial, such as favourite food or TV show, to deeply personal information, such as religious beliefs, and big turning points in one's private life. What parents do can hinder or

foster adolescent disclosure in parent-adolescent relationships. Soenens et al. (2006), examined the relationship between parenting dimensions and self-disclosure by comparing three models that describe the dynamics of parenting including self-disclosure, perceived parental knowledge, and problem behaviour. The study found that high responsiveness and high behavioural control and low psychological control can predict adolescent self-disclosure. For instance, according to Soenens et al. (2006), when parents build a relationship of trust with their adolescents, by creating a safe environment that is warm and supportive, it can make adolescents more eager to share inner feelings with parents and others. In another study, Vieno et al. (2009) examined the relationship between parenting, adolescent self-disclosure, and antisocial behaviour. The results indicated that parenting practices and styles correlated with parental knowledge of adolescents' whereabouts and activities, antisocial behaviour, and adolescent disclosure. However, further analyses showed a significant relationship between mothers' control and antisocial behaviour in teenage boys.

Presently, parents promote and encourage self-disclosure from children, because voluntary disclosure from a child enables parents to know more about him/her and also helps in building an atmosphere of trust and

honesty towards each other. A child's disclosure to his or her parents is related to the child's perceptions of the overall quality of family communication. Greater disclosure in relationships shows greater involvement (emotional), liking, feeling of intimacy and relationship satisfaction. Self-disclosure, depending on the reaction of relationship partners, also plays an important role in validating self-worth and personal identity. Adolescents may disclose less to parents because the content may become less acceptable. Reduced self-disclosure in adolescent is a part of the developmental process of separation and individuation in which the parents and the adolescent both play a major role. Factors such as the relationship between the communicators, the gender of the communicators, the specific mode of communication and the context of the interaction appear to moderate the degree of disclosure.

Adolescents' lack of disclosure has been a source of heartache and disaster for so many families. Teenagers who internalize frustration and have negative emotions are vulnerable to suicide and other anti-social vices. Studies have shown a link between a lack of sharing inner feelings and adolescent suicide and other anti-social behaviours. Horesh and Apter (2006) examined the relationship between self-disclosure, depression, anxiety and suicidal behaviour among adolescent psychiatric inpatients and found a significant correlation between

suicidality and low levels of self-disclosure. The result of the study suggests that adolescents who scored lower on sharing feelings have a higher chance of committing suicide or getting involved in other unhealthy behaviours. From the ongoing, parenting styles adopted by parents of adolescents are very vital in the adolescent's level of self-esteem and self-disclosure development. Thus, the interest of this study was to investigate the influence of the various parenting styles on self-esteem and self-disclosure which will help to produce well-behaved adolescents in Nsukka urban.

Objectives of the study: The specific objectives of the study were to:

1. assess parenting style used on secondary school students in Nsukka Urban;
2. assess the self-esteem levels of the students;
3. assess the self-disclosure levels of the students;
4. determine the relationship between socio-economic factors and self-esteem and self-disclosure levels of adolescents in Nsukka Urban.
5. determine the relationship of parenting styles with levels of self-esteem and self-disclosures of adolescents in Nsukka Urban

Methodology

Study design: Cross-sectional survey research design was adopted for the study.

Population for the study: The population for the study consisted of 3,241 students from 15 public senior secondary schools in Nsukka Urban Enugu state.

Sample size: Sampling was done in multiple stages. In the first stage 60% of the 15 schools, a total of 9 schools were selected from the list of schools using simple random sampling by balloting. In the second stage, the WHO (2013) formula for calculating sample size in a population was used to calculate a sample size of 344. The third stage involved the use of proportionate sampling to determine the number of subjects from each of the nine schools. Finally, simple random sampling without replacement was used to select respondents from classes SS1 and SS2 in the nine selected schools to participate in the study.

Instrument for data collection: The data for this study were collected using three standardized instruments and a structured questionnaire. The structured questionnaire elicited data on the socio-economic characteristics of the respondents. The first standardized instrument was the PS-FFQ (Parenting Style Four Factor Questionnaire) developed by Shyny (2017). The PS-FFQ contains 32 items measuring four parenting styles; authoritarian, authoritative, permissive and uninvolved parenting styles. Responses were on a 5-point Likert scale from never (1) to all the time (5). The numbers entered by the respondents for each style were

summed up and the style they scored highest in was taken as the parenting style used on them. Respondents' self-esteem was assessed using the Adolescent Self-esteem Questionnaire (ASQ) developed by Hafekost, et al. (2017). The ASQ is a 13-item measure of global self-esteem which was on a 5-point Likert scale from hardly ever (1) to almost all the time (5). Item scores were summed, and a higher score reflects higher levels of self-esteem and vice versa. The Jourard 60-item self-disclosure questionnaire by Jourard and Lasakow (1958) was modified to 42 items and used to assess adolescents' self-disclosure in areas such as attitude, taste and interest, studies, money, item shared, personality and body. It was arranged on a 4-point rating scale of "I have not told others about it (0)", "I talked in general terms about this (1)", "I talked in full detail (2)" and "I lied about it (0)." The numerical entries were summed yielding totals which constituted the self-disclosure scores.

Validity and reliability of the instrument: The instruments were validated by three experts from the Department of Home Science and Management, University of Nigeria, Nsukka. Their suggestions and corrections were used to produce the final version of the questionnaire used for the study. To determine the reliability of the questionnaire, the "trial testing of the instrument" was done using a Government Senior Secondary School in Udenu L.G.A.,

which shares similar characteristics with Nsukka Urban. Cronbach Alfa reliability formula was used to obtain a significant reliability coefficient of 0.80. **Method of data collection:** Data were collected with the help of two trained research assistants using the research instrument. The copies of the questionnaire were distributed by hand to the respondents in their various classrooms by the researchers and the trained assistants. The respondents were given sufficient time to fill out the questionnaire and then the questionnaire was collected the same day from the respondents to increase the chances of total return of the instrument.

Data and statistical analysis: The total obtainable scores for each style on the PS-FFQ was 40. The scores of the respondents for each style were summed and the style in which they obtained the highest scores was taken as the dominant parenting style used on them. Item scores on the AQ were summed with 65 as the highest obtainable score. Scores of 40 and above reflected high self-esteem levels while scores less than 40 were regarded as low self-esteem. The total obtainable score from the modified self-disclosure questionnaire was 84. Scores of 40 and above were regarded as high self-disclosure while scores below 40 reflected low self-disclosure.

The data from the questionnaire were coded and entered into the Statistical Product and Service Solution (IBM-SPSS) version 23.0. Data were

presented in frequencies; percentages, means and standard deviations. Chi-square was used to test the relationship between parenting styles and self-esteem and self-disclosure. The significance level was accepted at $p < 0.05$.

Results

Socio-economic characteristics of respondents: The socio-economic characteristics of the respondents showed that 52.0% of them are males while 48.0% were females. The majority (93.0%) of the respondents were 14-17 years of age. The occupation of the parents showed 41.00% of their mothers were civil servants while 45.1% of their fathers were civil servants. The highest educational level of a greater proportion (45.6%) of their fathers was secondary school certification, while

more than half (52.9%) of their mothers' had their highest educational level as secondary school education. More than half (57.30%) of the respondents' families had above ₦50,000 as their household monthly income. A greater proportion of the respondents had 1-4 as their household size.

Parenting styles used on adolescents in Nsukka Urban

Table 1 presents the frequency and percentage of responses on Parenting Styles used by the parents of the respondents. Authoritative parenting style rated highest (52.00%), authoritarian parenting style was used by 39.50% of their families, while permissive parenting style was used by 4.40% of the families, and neglectful parenting style was the least (4.10%) used by the families in Nsukka urban.

Table 1: Frequency and percentage responses on the parenting styles used on the respondents

Parenting Styles	Frequency	Percentage
Authoritative	179	52.0
Authoritarian	136	39.5
Permissive	15	4.4
Neglectful	14	4.1
Total	344	100.0

Table 2 shows the percentage levels of self-esteem and self-disclosure of the respondents. The majority (86.34%) of respondents had high self-esteem, while 13.66%

of them had low self-esteem. Respondents with a high level of self-disclosure were 78.80% and 21.20% of the respondents had low self-disclosure.

Table 2: Frequency and Percentage distribution of self-esteem and self-disclosure levels of Respondents

Level of self-esteem/ self-disclosure	Frequency	Percentage
Low self-esteem	47	13.7
High self-esteem	297	86.3
Total	344	100.00
Low self-disclosure	73	21.2
High self-disclosure	271	78.8
Total	344	100.0

Table 3 shows the relationship between self-esteem levels and the socio-economic characteristics of the respondents. Gender was not significantly ($p > 0.05$) related to the self-esteem level of the respondents. Greater percentages (86.7% females and 86.0% males) of the respondents had high self-esteem. Family income has a significant ($p < 0.05$) relationship with the self-esteem

levels of adolescents. The majority (89.3%) of the respondents with high self-esteem have a family monthly income above ₦50,000. Household size was not significantly ($p > 0.05$) associated with the self-esteem of the respondents. The proportion of the respondents with high self-esteem did not differ across different household sizes.

Table 3: Relationship between self-esteem levels and socio-economic characteristics of the respondents

Variable	Low Self-Esteem F (%)	High self-esteem F (%)	Total F (%)
Gender			
Male	25 (14.0)	154 (86.0)	179 (100.0)
Female	22 (13.3)	143 (86.7)	165 (100.0)
		$\chi^2 = 0.029$, $df = 1$, $p = 0.877$	
Family monthly income			
Less than ₦30,000	13 (29.5)	31 (70.5)	44 (100.0)
₦30,000- ₦50,000	13 (12.6)	90 (87.4)	103 (100.0)
Above ₦50,000	21 (10.7)	176 (89.3)	197 (100.0)
		$\chi^2 = 11.010$, $df = 2$, $p = 0.004^*$	

Household size			
1-4	21 (11.9)	156 (88.1)	177 (100.0)
5-8	20 (14.9)	114 (85.1)	134 (100.0)
More than 8	6 (18.2)	27 (81.8)	33 (100.0)
$\chi^2=1.238, df = 2, p = 0.539$			

χ^2 = Chi-square value; p = Level of significance; df = degree of freedom; *Correlation is significant at $p < 0.05$.

Table 4 presents the relationship between self-disclosure levels and the socio-economic characteristics of the respondents in Nsukka Urban. The gender of the respondents has no significant ($P > 0.05$) relationship with their self-disclosure levels. The majority (79.3% males and 78.2% females) of the respondents had high self-disclosure. Monthly family income was significantly ($p < 0.05$)

related to the self-disclosure levels of the respondents. The majority (85.8%) of the respondents with high self-disclosure had a monthly income of above ₦50,000. The household size of the respondents was significantly ($p < 0.05$) related to their self-disclosure levels. The majority (83.6%) of the respondents with high levels of self-disclosure had small household sizes of 1-4 persons.

Table 4: Relationship between self-disclosure levels and socio-economic characteristics of the Respondents

Variable	Low self-disclosure F (%)	High self-disclosure F (%)	Total F (%)
Gender			
Male	37 (20.7)	142 (79.3)	179 (100.0)
Female	36 (21.8)	129 (78.2)	165 (100.0)
$\chi^2=0.068, df = 1, p = 0.895$			
Family monthly income			
Less than ₦30,000	20 (45.5)	24 (54.5)	44 (100.0)
₦30,000-₦50,000	25 (24.3)	78 (75.7)	103 (100.0)
Above ₦50,000	28 (14.2)	169 (85.8)	197 (100.0)
$\chi^2=21.817, df = 2, p = 0.000^*$			
Household size			
1-4	29 (16.4)	148 (83.6)	177 (100.0)
5-8	33 (24.6)	101 (75.4)	134 (100.0)
More than 8	11 (33.3)	22 (66.7)	33 (100.0)
$\chi^2=6.303, df = 2, p = 0.043^*$			

χ^2 = Chi-square value; p = Level of significance; df = degree of freedom; *Correlation is significant at $p < 0.05$

Table 5 shows the relationship between self-esteem and self-disclosure of adolescents and the parenting styles used for them in Nsukka Urban. Self-esteem was significantly ($p < 0.05$) related to the parenting styles used. A greater proportion (54.9%) of the respondents with authoritative parenting style had high self-esteem compared to other styles while 21.3% of respondents with low self-esteem had

neglectful parenting style. Self-disclosure was also significantly ($p < 0.05$) related to the parenting styles used by the parents of the respondents. A greater percentage (56.1%) of adolescents with an authoritative parenting style had high self-disclosure levels compared to other styles while 12.3% of those with low self-disclosure had neglectful parents.

Table 5: Relationship of self-esteem and self-disclosure levels with parenting styles adopted in Nsukka Urban

Variable	Authoritative F (%)	Authoritarian F (%)	Permissive F (%)	Neglectful F (%)	Total F (%)
Self-esteem					
Low self-esteem	16 (34.0)	17 (36.2)	4 (8.5)	10 (21.3)	47 (100.0)
High self-esteem	163 (54.9)	119 (40.1)	11 (3.7)	4 (1.3)	297 (100.0)
$\chi^2 = 45.296, df = 3, p = 0.000^*$					
Self-disclosure					
Low self-disclosure	27 (37.0)	29 (39.7)	8 (11.0)	9 (12.3)	73 (100.0)
High self-disclosure	152 (56.1)	107 (39.5)	7 (2.6)	5 (1.8)	271 (100.0)
$\chi^2 = 28.817, df = 3, p = 0.000^*$					

χ^2 = Chi-square value; p = Level of significance; df = degree of freedom; *Correlation is significant at $p < 0.05$

Discussion

The finding of the study showed that the four parenting styles investigated were used by the adolescent families in the study area. The parenting styles include authoritative, authoritarian, permissive, and neglectful parenting styles. The result showed that the authoritative parenting style was the

most prevalent parenting style used by parents in Nsukka urban, while very few used authoritarian, permissive, and neglectful parenting styles. Authoritative parents are more aware of a child's feelings and capabilities and support the development of a child's autonomy within reasonable limits. Authoritative parenting is associated with children maintaining a higher

level of social competence (Boudreault-Bouchard et al., 2013). According to Bashir (2020), in the United States, roughly 46% of parents use an authoritative parenting style, 26% authoritarian parenting style, 18% permissive parenting style, and 10% neglectful parenting style. This trend is in line with the findings of the current study. Parents still have a purpose of taking care of their young children, shaping their behaviours and mode of reaction to issues and things within them and their immediate environment using different parenting styles. On a similar note Nelson et al. (2011) reported that overall, most studies with Western samples have consistently found that an authoritative parenting style is associated with higher levels of parent-adolescent cohesion and lower levels of conflict frequency, conflict intensity, and total conflict.

Self-esteem is an individual's subjective evaluation of their worth. Self-esteem encompasses beliefs about oneself as well as emotional status, such as triumph, despair, pride, and shame. The self-concept is what one thinks about the self, and self-esteem is the positive or negative evaluations of the self, that is, how one feels about the self (Smith & Mackie 2007). Self-esteem is a major key to success in life. The finding of the study showed that the majority of the respondents had high self-esteem and only very few of the adolescents had low self-esteem. When an individual has healthy/high self-esteem it means that he/she has a

balanced and accurate view of him/herself. For instance, one may have a good opinion of one's abilities but recognize one's flaws as well. This finding could be attributed to the enhanced family income of the respondents which had a significant influence on the parenting style as well manifesting in the adolescent's self-esteem. The finding is in line with the study by Sharma and Agarwala (2003), and Orth and Robins (2013) who went on to say that low level of self-esteem has been linked to serious behavioural problems, poor school performance, suicidal tendencies, and maladjustment. This low level of self-esteem leads to psychological problems such as depression, social anxiety, loneliness, and alienation among others (Harris & Orth, 2020).

Sharing information about oneself, or self-disclosing, is a fundamental interpersonal process that facilitates the attainment of key developmental milestones during adolescence. Self-disclosure is a fundamental interpersonal process that is influenced by a range of factors, such as the targets of disclosure (e.g. parents versus peers), depth or type of information to be conveyed (e.g. intimacy and/or valence of personal exchanges), as well as breadth or amount of information (e.g. the number of topics that are disclosed) (Omarzu, 2000). Adolescents need to articulate their sense of self when sharing personal information, and feedback from others not only helps them

validate the appropriateness of their feelings, thoughts, and behaviours but also supports the development of close relationships through building patterns of reciprocity (Peter & Valkenburg, 2009; Davis, 2012). These goals, while relevant across the lifespan, are particularly important in the context of adolescence as they are essential to forming a coherent sense of self or self-identity and developing intimate connections with peers and romantic partners (Meeus, 2011; Smith, 2017). Consequently, self-disclosure during adolescence has also been associated with positive developmental outcomes such as well-being (Valkenburg & Peter, 2007). The finding of this study showed that the majority of the respondents had high levels of self-disclosure. This implies that most of the adolescents in Nsukka Urban intentionally share their personal information with other people such as their friends and family members. According to Pathek (2012), self-disclosure is important in interpersonal relationships since the reciprocity nature fosters social closeness by developing relatedness, liking, and respect among people. Additionally, self-disclosure fosters close relationships and upholds a person's psychological well-being in interpersonal relationships. Although self-disclosure is a catalyst for bringing people closer together, it can inflict tension resulting in social isolation as well (Pathek, 2012). For instance, a study by Parsons et al. (2004) found

disclosing one's health status (e.g. positive HIV status) to one's partner could lead to rejection, stigma, loss of intimacy, and threats to personal well-being.

The finding of this study showed that the family monthly income of adolescents had a significant relationship with their self-esteem and self-disclosure levels. Adolescents with a household monthly income above fifty thousand naira had higher self-esteem and self-disclosure than those in other groups. According to Conger et al. (2002), financial stress can have a detrimental effect on parents, who may then change their parenting methods, which could have a negative emotional and psychological impact on adolescents. There is evidence that parents' socioeconomic conditions can affect the parenting style they adopt. For instance, the result of their study pointed to an association between challenging economic circumstances and poor parenting. (Conger et al. 2002). This does not in any way mean that parenting practices among parents from higher social economic backgrounds automatically predict a positive adolescent behavioural outcome. The findings of this study also showed no significant association of respondents' gender with their self-esteem and self-disclosure levels. Keijsers et al. (2010), in a longitudinal study of adolescents that measured gender differences in developmental changes and how that relates to adolescents keeping secrets from their

parents, reported a significant correlation between keeping secrets from parents and negative parent-child relationship among girls (the correlation is much less for boys). The number of offspring in the families of the adolescents had a significant relationship with their self-esteem level.

The finding of the study showed that higher self-esteem and self-disclosure levels of the respondents were significantly associated with authoritative and authoritarian parenting styles. This implies that children of parents with authoritarian and authoritative styles of parenting tend to have high self-esteem and self-disclosure. In line with the present study, Martinez et al. (2007), in their study found that parenting styles are related to adolescents' self-esteem in Brazil. The finding of a study by Puja (2013) is also consistent with that of the present study, in that a significant relationship existed between the adolescents' self-esteem and the parenting styles adopted by their parents. His result further showed that most adolescents with permissive and authoritative parents had higher self-esteem levels. Parenting style has also been linked with adolescents' self-disclosure according to the findings of this study. Soenens et al. (2006), examined the relationship between parenting dimensions and self-disclosure by comparing three models that describe the dynamics of parenting including self-disclosure, perceived

parental knowledge, and problem behaviour. The study found that high responsiveness, high behavioural control, and low psychological control can predict adolescent self-disclosure. For instance, when parents build a relationship of trust with their adolescents, by creating a safe environment that is warm and supportive, it can make adolescents more eager to share inner feelings with parents and others (Soenens et al, 2006).

Conclusion

The study provided insight into the self-esteem and self-disclosure levels of adolescents in Nsukka Urban and their association with the parenting styles used on them. The authoritative parenting style in which parents respond to children's needs as much as they demand responsibilities from them was the most prevalent type of parenting style in Nsukka Urban. How parents provided care and discipline to adolescents played a role in their self-esteem and self-disclosure levels. This is evident in the fact that a greater proportion of adolescents that had authoritative parenting had high self-esteem and self-disclosure levels. Household characteristics such as family income and household size were associated with the self-esteem and self-disclosure levels of adolescents. Adolescents who come from higher-income households had higher self-esteem and self-disclosure than those from lower-income families and those

in smaller households also showed a higher level of self-disclosure to their family members. Authoritative parenting, therefore, had a positive relationship with the self-esteem and self-disclosure levels of adolescents.

Recommendations

The following recommendations were made based on the findings of the study.

1. More research should be conducted in other parts of the state and country to provide national data on the topic.
2. Governmental and non-governmental organizations should create jobs that will give an acceptable window for parents to monitor their children and care for their children.
3. Financial assistance should be provided for families by the government as grants and job opportunities to assist in catering for their children and improve their standard of living.
4. Programs aimed at building adolescents' self-esteem and self-disclosure should be developed by government agencies.

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Influence of Social Media on Marital Relationships among Couples in Nwafor Orizu College of Education, Nsugbe

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Abstract

The study investigated the influence of social media on marital relationships among couples in Nwafor Orizu College of Education, Nsugbe. Six objectives guided the study. The study adopted a survey research design. The population for the study consisted of 288 teaching staff out of which a sample of 119 married staff were purposively selected. Data were collected with a structured questionnaire which was validated by three experts. The reliability of the instrument was established using Cronbach Alpha with a coefficient of 0.82. Data were analysed using percentages, means, and standard deviations. The results showed that the majority of the respondents used social media platforms like Email (100%), Facebook (96.2%), WhatsApp (98.1%), and Instagram (87.6%) to keep in touch with friends and family (3.53), and finding products to purchase (3.50). The study also showed that married couples spend two hours and more on the platforms (3.31). The study highlighted some of the positive influences of social media such as improving family cohesion and bond (3.90) and also the negative influences which include being distracted from paying attention to what is happening in one's spouse's life (2.71). The findings of the study also showed that making video calls, especially in long-distance relationships (3.80) can be used to improve marital communication. In conclusion, the respondents spend a lot of their free time engaging in social media activities which influence their communication with their spouses. It is recommended that couples reduce the time spent on social media and invest more of it in their spouses.

Keywords: Social Media, Communication, Married Couples, Marital Relationship

Introduction

Interaction is an inevitable and important aspect of marital relationships. A marital relationship is a relationship between husband and wife who are united civilly or

religiously. It involves a deep emotional and physical connection between the partners, and it is built on trust, respect, and love. Factors such as intimacy, locus of control, and self-esteem all account for marital

satisfaction (Udofia et al., 2021). Good communication skills are the key to any successful relationship because relationships are emotional and rely on interpersonal verbal and nonverbal exchanges between the two people involved (Smith, 2017). Effective personal communication is essential for building and maintaining strong relationships, including spousal relationships. The success of one's relationship is determined by how well one can communicate one's needs and actively listen to the needs of one's partner (Seattle Christian Counselling, 2020). Couples discuss their goals, ambitions, plans, daily encounters, and fears, as well as their challenges during interactions. According to Wedgate (2023), couples who spend quality time together can better understand each other's personalities and find the perfect balance in their relationship. Sometimes, the personal and private discussions are hindered as couples spend their time on social media use thereby, limiting the amount of time they spend with one another.

Communication has drastically advanced over the past few years due to the invention of the internet. Notably, the world can be referred to as a 'global village' as individuals can easily communicate with one another from all over the world at any time of the day. The internet has brought about tremendous changes in the society. Most importantly, it has led to the introduction of social media platforms whereby users can virtually interact with one another through messages, video calls, and

sharing pictures. Social media has become an indispensable component of modern daily functioning.

Social media has been defined by several authors. According to Dollarhide (2021), the term social media refers to a computer-based technology that facilitates the sharing of ideas, thoughts, and information through virtual networks and communities. Social media can be defined as any platform that allows you to share media such as pages, videos, or text in different formats (Kudumula, 2022). Social media is internet-based and gives users quick electronic communication of content, such as personal information, documents, videos, and photos. Users engage with social media via a computer, tablet, or smartphone via web-based software or applications (Dollarhide, 2021). The various types of social media according to Kudumula (2022) include; social networking sites which are sites mainly used for connecting with friends and family and focus more on person-to-person conversations for instance Facebook, LinkedIn, and Twitter; Image-based sites -image-based types of content like infographics, illustrations, and images capture the attention of users more, examples are social media apps like Pinterest, Instagram, and Snapchat are designed to amplify the sharing of images; Video sharing/streaming platforms -one major platform that reshaped how people interact with video content is YouTube; and Discussion forums which are very essential because they allow users to ask questions and get

answers from different people. Such platforms include Quora and Reddit (Kudumula, 2022).

Social media have taken on a large and growing part of the lives and daily functioning of not only the youth but also adults and old people (Zabadi, 2019). Individuals use it for work, and education, to search for information, communicate, interact with others, and have contact with popular culture (Stanislaw, 2015). People can use social media to stay connected to long-distance friends and family members or improve communication with their partners, children, and healthcare professionals (Jarai, 2022). A study by Kuske (2020) found that long-distance romantic relationship couples use social media sites that are more convenient and user-friendly.

In contrast, social media use can lead to less quality one-on-one time spent with loved ones and relationship dissatisfaction. These drawbacks may be related to pre-existing relationship issues or psychological conditions. As people spend more and more time communicating online and handling their daily tasks in cyberspace, they could spend less time interacting with one another in the physical world is the main anxiety (Giddens, 2002). A study by Zabadi (2019) found that married couples have access to most social networking, especially Facebook and WhatsApp, and spend a significant part of their time using social networking sites. Afolaranmi (2020), since more and more time is being devoted to the use of social media these days, couples are having

less time to be together. Experiences and studies have shown that social media is causing a lot of infidelity in marriage and eventual divorce in present-day society (Afolaranmi, 2020). A study carried out by Saleh & Mukhtar (2015) explored the relationship between social media and divorce and it found that the majority of people that subscribe to one or more social network sites are aware that it can lead to infidelity and divorce as well.

Presently, individuals, as well as couples, always make use of various social media platforms at different times of the day and some individuals spend so much time on the media that their efficiency in other roles is affected. This has led to a widening communication gap among family members and married couples. However, social media use could be effectively incorporated into the daily lives of modern couples to obtain a more satisfying marital relationship. This study, therefore, aims to investigate the influence of social media on marital relationships among couples in Nwafor Orizu College of Education, Nsugbe.

Objectives of the study: The objectives of the study were to:

1. identify the social media platforms used by married couples in Nwafor Orizu College of Education, Nsugbe;
2. investigate the social media activities of married couples;
3. identify how much time married couples spend on social media;

4. identify the positive influence of social media on communications among married couples;
5. identify the negative influence of social media on communications among married couples; and
6. identify ways in which social media can be used to improve communications among married couples.

Methodology

Design of the study: The study adopted a descriptive survey research design to investigate the influence of social media on marital relationships among couples in Nwafor Orizu College of Education, Nsugbe. According to Nworgu (2015), a descriptive survey is a type of research design in which a group of people or items are studied by collecting and analysing data from only a few people or items considered representative of the entire population

Population of the study: The population for the study comprised 288 teaching staff of Nwafor Orizu College of Education, Nsugbe from the 26 departments in the college.

Sample and Sampling Technique: The sample of the study consisted of 119 married teaching staff of the college. This sample was purposively selected based on their current marital status. All the married staff who were available and gave their consent participated in the study.

Instrument for Data Collection: A structured questionnaire titled Influence of Social Media on Marital Relationship among Couples was used for data collection. The

instrument consisted of seven sections (A, B, C, D, E, F, and G) based on the research objectives. Section A contained data on the demographic data of the respondents. Section B elicited responses on social media platforms used by married couples. Section C obtained data on the social media activities of the respondents. Section D elicited data on the time spent on social media platforms. Sections E and F obtained data on the positive and negative influences of social media on marital communications and Section G assessed ways in which social media can be used to improve marital communication. Section B of the instrument was designed on a percentage scale of 'used' social media platforms while sections C-D were designed on a 4-point rating scale of Strongly Agree (SA, 4 points), Agree (A, 3 points), Disagree (D, 2 points) and Strongly Disagree (SD, 1 point)

Validation and Reliability of the Instrument: The instrument was validated by three experts; one from Measurement and Evaluation, one from the Home Economics Department in Nwafor Orizu College of Education, Nsugbe, and one from the Department of Home Science and Management of the University of Nigeria, Nsukka. The corrections made by the experts were effected and final copies of the instrument were obtained which were then used for the study. The reliability of the instrument was established using Cronbach Alpha reliability testing conducted at Grundtvig Institute, Oba, Anambra State. Twenty (20)

respondents participated. The Cronbach Alpha procedure yielded a co-efficient of 0.82 indicating a high internal consistency of the items.

Method of Data Collection: Data were collected with the help of two trained research assistants using the questionnaire. One hundred and nineteen (119) hard copies of the questionnaire were distributed by hand to the married teaching staff of the college and a total of 105 completed copies of the questionnaire were retrieved after two days for analysis by the researchers and the two trained research assistants. The data collection exercise lasted a total of seven days. The percentage of the instrument retrieved was 88%.

Data and Statistical Analysis: The data collected for this study were analysed using the Statistical Package for Social Sciences (SPSS, version 23). Frequency, percentages, mean, and standard deviation were used to analyse the data. The percentages were used for the responses on social media platforms used by the respondents. Means and standard deviation were used on respondents' social media activities, time spent on social media, negative and positive influences of social media as well as ways to improve communication among married couples. A percentage of 50% and above was considered an accepted used platform, and the reverse was the case

when the percentage was below 50%. The cut-off mean score was 2.50. This formed the basis for accepting or rejecting any item on the questionnaire. A mean score of 2.50 and above was accepted as common social media activities, time spent on social media, negative and positive influences of social media as well as ways to improve communication, while a mean score less than 2.50 was rejected.

Results

Demographic characteristics of the respondents

The demographic characteristics of the married teaching staff of Nwafor Orizu College of Education, Nsugbe were as follows; many (40%) of the respondents were between 41 years and above; 41.9% have been married for 16 to 20 years and 38.1% of the respondents had a total of 4 children.

Commonly used social media platforms by the respondents

Table 1 presents nine social media platforms used by the respondents. The social media platforms mostly used were Email (100%), WhatsApp (98.1%) Facebook (96.2%) Instagram (87.6%), and LinkedIn (53.3%). While Twitter (49.5%) Tiktok (47.6%) Youtube (48.6%) and Snapchat (45.7%) had percentages of less than 50% and were not accepted as used social media platforms.

Table 1: Frequency and Percentage (%) Responses on commonly used Social Media Platforms by the Respondents

Social Media Platforms Used	Frequency	Percentage	Decision
Facebook	101	96.2	Accepted
WhatsApp	103	98.1	Accepted
Instagram	92	87.6	Accepted
Twitter	52	49.5	Rejected
LinkedIn	56	53.3	Accepted
Tiktok	50	47.6	Rejected
Youtube	51	48.6	Rejected
Snapchat	48	45.7	Rejected
Email	105	100	Accepted

Table 2 presents eight activities done on social media by the respondents. All of the activities listed were accepted except for Meeting new people which had an overall mean of 2.36. The accepted items had their overall mean from 2.61 to 3.56 and include; 'staying up-to-date with news and current events (mean =3.56); 'keeping in touch with friends and family (mean = 3.53); 'finding products to purchase/inspiration for things to do (mean = 3.50); 'finding entertaining content' (mean = 2.92) and 'sharing photos or videos with others (mean = 2.70).

Table 2: Mean and Standard Deviation Responses on Social Media Activities of the Respondents

Activities Done on Social Media	Mean (\bar{x})	Standard Deviation	Decision
Keeping in touch with friends and family	3.53	0.50	Accepted
Meeting new people	2.36	1.14	Rejected
Finding entertaining content	2.92	0.84	Accepted
Finding products to purchase/inspiration for things to do	3.50	0.50	Accepted
General networking with other people	3.49	0.50	Accepted
Filling up spare time	2.61	1.21	Accepted
Sharing photos or videos with others	2.70	1.06	Accepted
Staying up to date with news and current events	3.56	0.50	Accepted
Grand Mean (\bar{x})	3.08	0.78	Accepted

Table 3 shows the mean and standard deviation responses on time spent on social media by the respondents. Two items, 'I spend 2 to 3 hours daily on social media' (mean = 2.99) and 'I spend more than 3 hours daily on social media' (mean = 3.31) were accepted as time respondents spend on social media. Four items with corresponding means less than 2.50 rejected as time spent on social media by the respondents include; "I spend less than 30 minutes daily on social media (1.92);" 'I spend 30 minutes to

1 hour daily on social media (1.96); 'I spend 1 to 2 hours daily on social media (2.13);' and 'I go days without visiting any social media platform (2.13).'

Table 3: Mean and Standard Deviation Responses on Time Spent on Social Media by the Respondents

Time Spent on Social Media	Mean (\bar{x})	Standard Deviation	Decision
I spend less than 30 minutes daily on social media	1.92	0.83	Rejected
I spend 30 minutes to 1 hour daily on social media	1.96	0.88	Rejected
I spend 1 to 2 hours daily on social media	2.13	0.81	Rejected
I spend 2 to 3 hours daily on social media	2.99	0.79	Accepted
I spend more than 3 hours daily on social media	3.31	0.80	Accepted
I go days without visiting any social media platform	2.13	0.77	Rejected

Table 4 shows mean and standard deviation responses on the positive influence of social media by the respondents. All of the items listed were accepted and had their overall means from 3.46 to 3.90, these include; 'they improve our family cohesion and bond (3.90);' 'they improve healthy communication between my spouse and me (3.88);' 'they help us in facing up to life cycle transitions (3.60);' 'I feel more connected to my spouse as I can see his/her daily happenings on social media (3.59);' 'they reduce physical distance between my spouse and me (3.55);' 'they strengthen family resilience (that is the ability to face up positively to traumatic events, to reorganize functionally after some difficulties) (3.50);' and 'social media help my spouse and me relive amazing family moments (3.46).'

Table 4: Mean and Standard Deviation Responses on the Positive Influence of Social Media by the Respondents

Positive Influence of Social Media	Mean (\bar{x})	Standard Deviation	Decision
They improve healthy communication between my spouse and I	3.88	0.33	Accepted
They improve our family cohesion and bond.	3.90	0.31	Accepted
They reduce the physical distance between my spouse and I	3.55	0.50	Accepted
They help us in facing up to life cycle transitions.	3.60	0.49	Accepted
They strengthen family resilience (that is the ability to face up positively to traumatic events, to reorganize functionally after some difficulties).	3.50	0.50	Accepted
Social media help my spouse and I relive amazing family moments	3.46	0.50	Accepted

I feel more connected to my spouse as I can see his/her daily happenings on social media	3.59	0.49	Accepted
Grand Mean (\bar{x})	3.64	0.45	Accepted

Table 5 presents nine positive influences of social media by the respondents. From the table, it was found that the majority of the items were upheld except for those of 'either I or my spouse has had an affair with someone we met on social media' which had an overall mean of 2.31 and 'I feel jealous when my spouse is communicating with someone of the opposite sex on social media' which had an overall mean of 2.41. The accepted items had their overall means from 2.50 to 2.97 and include; 'my spouse and I often have disagreement and conflict over the amount of time he/she spends on social media' with a mean of 2.97; 'when I am on social media, I

sometimes get distracted from paying close attention to what is happening in my spouse's lives' with a mean of 2.71; 'my spouse and I do not spend quality time together because of social media' which had a mean of 2.69; 'either I or my spouse have been tempted to have a romantic relationship with someone we met on social media' with a mean of 2.55; 'I feel upset and enraged with some of the things my spouse shares on social media' which had a mean of 2.53; 'I compare my life with those of other people on social media' with a mean of 2.50; and 'I do not trust what my husband/ wife does on social media' which had a mean of 2.50.

Table 5: Mean and Standard Deviation Responses on Negative Influences of Social Media by the Respondents

Negative Influences of Social Media	Mean (\bar{x})	Standard Deviation	Decision
My spouse and I do not spend quality time together because of social media	2.69	1.24	Accepted
Either I or my spouse has been tempted to have a romantic relationship with someone we met on social media	2.55	1.13	Accepted
Either I or my spouse has had an affair with someone we met on social media	2.31	1.13	Rejected
I feel upset and enraged with some of the things my spouse shares on social media	2.53	1.13	Accepted
I compare my life with those of other people on social media	2.50	1.18	Accepted
I feel jealous when my spouse is communicating with someone of the opposite sex on social media	2.41	1.12	Rejected
I do not trust what my husband/ wife does on social media	2.50	1.09	Accepted

My spouse and I often have disagreements and conflicts over the amount of time he/she spends on social media	2.97	0.81	Accepted
When I am on social media, I sometimes get distracted from paying close attention to what is happening in my spouse's life.	2.71	0.99	Accepted
Grand Mean (\bar{x})	2.57	1.09	Accepted

Table 6 presents six ways social media can be used to improve communication by the respondents. From the table, all of the items listed were accepted and had their overall mean from 3.45 to 3.77. Among the accepted ways social media can improve communication are; 'making video calls, especially in long-distance relationships' (3.80); 'sending checking-in texts to a spouse to let them know they are being thought about' (3.77); 'expressing public admiration and appreciation on social media platforms like Facebook and Instagram' (3.54); 'sharing possible gift ideas found online, date night ideas and locations as well as silly pictures, jokes and memes' (3.50); 'spending time together by watching funny video clips and movies on social media' (3.48); and 'sharing interesting and entertaining social media posts to spouses' (3.45).

Table 6: Mean and Standard Deviation Responses on Ways Social Media can Improve Communication by the Respondents

Items	Mean (\bar{x})	Standard Deviation	Decision
Sending checking-in texts to a spouse to let them know they are being thought about	3.77	0.42	Accepted
Making video calls, especially in long-distance relationships	3.80	0.40	Accepted
Expressing public admiration and appreciation on social media platforms like Facebook and Instagram	3.54	0.50	Accepted
Sharing interesting and entertaining social media posts with spouses	3.45	0.50	Accepted
Sharing possible gift ideas found online, date night ideas and locations as well as silly pictures, jokes and memes.	3.50	0.50	Accepted
Spending time together by watching funny video clips and movies on social media	3.48	0.50	Accepted
Grand Mean (\bar{x})	3.59	0.47	Accepted

Discussion

The purpose of this study was to determine the influence of social media on marital relationships among couples. Social media influence marital relationships both positively and negatively. The research findings showed that most

couples spend time on social media platforms such as Email, WhatsApp, Facebook, Instagram and LinkedIn. This is probably because social media platforms such as Email can be used for work and work-related activities. Also, these social media platforms facilitate keeping in touch with friends and family members. These findings are in line with Kudumula (2022), who listed various types of social media commonly used in modern times, such as social networking sites like Facebook, LinkedIn, and Twitter; image-based sites examples are social media apps like Pinterest, Instagram, and Snapchat; and video sharing/streaming platforms for example YouTube.

The findings of the study also showed that married couples use social media platforms for such activities as keeping in touch with friends and family, finding entertaining content online, staying up to date with news and current events, and finding products to purchase/inspiration for things to do. These may be attributed to the fact that social media can be applied to almost every aspect of family life and interaction. It is often easier and more convenient to access information, provide information and communicate through social media. These findings are in agreement with Stanislaw (2015), who stated that we use social media for work, education, to search for information, communicate, interact with others and have contact with popular culture.

The findings of the study showed that married couples spend two hours and more daily on social media. This is probably because most of the social media platforms are easily operated on mobile phones, hence it is more likely for one to lose track of time while scrolling through the platforms on the phone. This is in support of findings by Zabadi (2019) that married couples have access to most social networking, especially Facebook and WhatsApp and spend a significant part of their time using social networking sites. These findings are contrary to the study by Gull et al (2019) which found one to two hours as an ideal time for couples to spend on social media sites daily. The finding of this study indicates that couples might be overusing social media platforms.

Also, the study found that social media use influences married couples positively such as improving healthy communication between spouses, improving family cohesion and bond as well as reducing physical distance between spouses. This is probably because social media allows a variety of communication channels such as texts, and calls as well as sharing pictures and videos which help married couples feel connected to one another. These findings are in agreement with Jarai (2022), who posited that people can use social media to stay connected to long-distance friends and family members or improve communication with their partners, children, and healthcare professionals.

However, the study found that social media use influences married

couples negatively such as less quality time spent together by couples because of social media, the temptation of having a romantic relationship with someone on social media and sometimes getting distracted from paying close attention to what is happening in one's spouse's lives. This may be so, because of a breakdown in communication between spouses caused by social media, as couples spend less time talking to each other but rather spend more time scrolling through social media feeds on their phones. Also, the findings of the study showed that spouses often have disagreements and conflicts over the amount of time they spend on social media. These findings are in line with Afolaranmi (2020) who posited that since more and more time is being devoted to the use of social media these days, couples are having less time to be together and that social media is causing a lot of infidelity in marriage and eventual divorce in the present-day society.

The findings of the study also showed ways in which social media can be used to improve communication among couples such as making video calls, especially in long-distance relationships, sharing interesting and entertaining social media posts with spouses and spending time together by watching funny video clips and movies on social media. These findings are in agreement with Games (2023) who stated that in romantic relationships, where couples are long-distance or have to travel often for work, it can help them feel like they are part of

each other's day-to-day life, even when apart

Conclusion

Married couples in Nwafor Orizu College of Education, Nsugbe spend a lot (two hours and more) of their free time on social media platforms like Email, WhatsApp, Facebook, Instagram and LinkedIn. They engage in social media activities such as keeping in touch with friends and family, finding entertaining content online, staying up to date with news and current events, and finding products to purchase/inspiration for things to do. Although social media usage positively influenced their communication with their spouses in ways such as improving healthy communication between spouses, improving family cohesion and bond as well as reducing physical distance between spouses. However, there were negative influences of social media on marital relationships such as less quality time spent together by couples because of social media, the temptation of having a romantic relationship with someone on social media and sometimes getting distracted from paying close attention to what is happening in one's spouse's lives. However, there are ways in which social media can be incorporated into their interaction with their spouses to improve communication and they include making video calls, especially in long-distance relationships and sharing interesting and entertaining social media posts with spouses.

Recommendations

Based on the findings of the study, the following recommendations were made;

1. Married couples should reduce the amount of time they spend on social media to spend more of their leisure time with one another.
2. Spouses should spend some of their social media time together. This they can do by watching funny video clips and movies on social media.
3. Spouses should try to keep in touch with one another through social media, especially in long-distance relationships.

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Usage of WhatsApp Messenger for Learning among Students in Selected Tertiary Institutions in Oyo State

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Abstract

This study investigated the usage of WhatsApp mobile applications among students in selected tertiary institutions in Oyo State. The objectives of the study were to establish WhatsApp usage among students; identify the significance of WhatsApp Messenger among students, and determine the challenges students faced in the use of WhatsApp. To achieve these objectives a survey was undertaken in the selected tertiary institutions among students using questionnaires. The results of the study showed that there was widespread use of the WhatsApp application among students in the selected institutions. It was used for learning purposes of conveying academic tasks such as assignment and tutorial questions, time tables and notices. The findings also revealed that for academic purposes WhatsApp was mostly used for alerting friends about the absence or presence of lecturers, conveyance of academic tasks such as assignments, tutorial questions, time-tables and notices. It was also established that there was very little communication between students and lecturers using WhatsApp for academic purposes. The study concluded that WhatsApp was a viable delivery of academic material in the teaching and learning environment. It was seen to be a user-friendly, cheap, and effective means of communication among students. However, users also pointed out some challenges they faced in their usage of WhatsApp which included lack of privacy, lack of security of personal information and irregular internet access.

Keywords: Usage, WhatsApp messenger, Students, Learning

Introduction

Technology has an immense impact on human lives. The use of social media applications such as this application has become popular as a learning tool in many institutions (Mistar and Embi, 2016). Education currently tries to develop new critical

skills for students not only to learn content. Technology offers teachers the ability to transform the quality of instruction; achieve a more student-centred learning environment, have more differentiated instruction and develop problem or project-based learning and demand higher-order

thinking skills. Teaching in all settings should encompass student-centred approaches to learning. Technology should not be used only as a tool for demonstration, as an electronic overhead projector or blackboard; rather the use of technology by students should be an integral part of instruction (Sayan, 2016). It has generally been observed that most students very readily adapt to social media and like to interact with their friends this way. Therefore, many teachers are seeing a great deal of success in using this means of communicating with their students (Hemmi, Bayne & Land, 2009). They maintained that since students already collaborate, search for information, communicate and socialize using web technologies as part of their everyday lives, there is no reason for them not to use the same skills and behaviours in the classroom to support learning.

Educational systems around the world are under increasing pressure to use new information communication technologies (ICTs) to teach students the knowledge and skills they need in the 21st century. The influence of these media on learning and teaching environments is growing more each year. Message applications can reinforce class material and positively influence the discussion, collaborative work and authoring. Educators are experimenting with these technologies hoping to stimulate critical thinking skills, collaboration and knowledge construction (Sayan, 2016). A report published in the United States by the 2007 National

School Board Association found that 96 per cent of youth in this age range have used social networking tools at some time, with their average engagement with them rivalling time spent watching TV at 9 hours a week. Yet perhaps the most stunning statistic of the report is that the topic of most conversation at these sites is education; 60 per cent of the students' surveys said they use the sites to talk about education topics and more than 50 per cent use them to talk about specific schoolwork (Klopfer, et al., 2009).

A great deal of education research provides evidence for the effectiveness of using social media technologies directly in the context of traditional education situations or online education (Barab and Duffy, 2000). Some studies have demonstrated the benefits of online social interaction in the learning process. Positive aspects of online interaction with teachers and peers include the following: access to peer and expert knowledge, the ability to receive feedback from teachers and peers, and an opportunity to reflect on the exchanged messages (Ellis, 2001). By expressing their thoughts, discussing and challenging the ideas of others, and working together towards a group solution to a given problem, students develop critical thinking skills as well as skills of self-reflection and co-construction of knowledge and meaning (Brindley et al., 2009).

A study by Junco et al. (2011) sought to discover a causal link between the use of Twitter and other social media and student

engagement. Twitter has been studied for its effect on student interaction and engagement, it was found that students engaged with faculty and each other in a vibrant and connected virtual learning environment (Junco et al., 2011). Yeboah and Ewur (2014) undertook a study whose aim was to establish the impact of WhatsApp messenger usage on students' performance in tertiary institutions in Ghana. The study indicated that WhatsApp had been a necessary tool for students as it could enhance their performance if used positively. They explained that WhatsApp made communication easier and faster, thereby enhancing the effective flow of information and idea sharing among students. They, however, cautioned that if used negatively, WhatsApp could have an adverse impact on the performance of students. Among the negative impacts they identified were that it took much of students' study time; resulted in procrastination-related problems, destroyed students' grammar and spelling; led to a lack of concentration during lectures; and difficulty in balancing online activities and academic preparation.

WhatsApp has some academic advantages. It enables quick transference of links to study materials, unlike any other technologies, which often do not work, or other forms of communication that students do not just use after school hours. It also ensures that everyone gets the message, whether it is a video intended for class or a copy of a solution for an exercise sent after

school hours (Bouhnik & Deshen, 2014).

Learning requires daily social interactions between students and teachers on one side and between students and daily life events on the other; "bridging the all-too-well-known gap between the classroom and the real world. Learning has meaning and relates to the real world because it is modelled on the systems of the real world" (Klopfer et al., 2009). Institutions of learning strive to develop and support methods to improve the effectiveness and efficiency of interaction and collaboration among students and their teachers. Most web social media tools have been developed to maintain, manage, and improve social interactions between people; where people can easily access, reuse or comment on content that is authored by others. The evolving learning environments allow students to learn anytime and anywhere (Wetzel, 2010). It is hoped that the findings of this study will increase awareness among both lecturers and students regarding the positive effect of WhatsApp usage in an academic environment. It is hoped that the study will encourage lecturers and students to explore effective and more organized strategies for integrating WhatsApp into the teaching and learning process.

Educational mobile tools have emerged and show great potential to help students construct and share information and knowledge for learning through computers or mobile devices (Pence, 2007).

Educational research demonstrates convincingly that immediate and frequent feedback improves learning (Hodder et al., 1989). Furthermore, "social networks may play an important role in raising awareness about the reliable resources of information among students and society by providing alternative sources of knowledge" (Battrawi & Muhtaseb, 2013). WhatsApp is a smartphone application that operates on nearly all current types of devices and operating systems. The application has been on the market since 2010. The declared purpose of the developers was to replace the existing short message service (SMS) platform with a system that is free of charge in an ad-free environment. WhatsApp is used as a means of sending and receiving messages to and from individuals or groups. It includes a variety of functions, such as text messages, attached images, audio files, video files and links to web addresses (Sayan, 2016).

Mistar and Embi (2016) believe that with the fact that WhatsApp has many benefits for students. Firstly, it promotes cooperation between peers can be promoted through the possibility of sharing content and supporting material, for example, research articles, e-books, laws, YouTube channels, links, and so on WhatsApp can also be used for data collection since the teacher/researcher/student researcher can use this medium to send voice or written questions and receive answers in the same environment, thus promoting quick feedback.

Secondly, the teacher/moderator can use WhatsApp groups as a means to assess student participation (Thorton, 2015) WhatsApp is also ideal to motivate and stimulate students: It is very important in the teaching-learning process to involve students so that they reach the objectives defined by the curriculum and their objectives. Through WhatsApp, students can feel more comfortable than during face-to-face classes to ask questions or share interests, even when talking about contexts with large classes (+/- 50 students) it is much easier for the teacher to evaluate the participation of students and reward them throughout the process than limit this to a test/exam grade (Chen, 2018) As a mobile learning tool, WhatsApp also affords higher forms of inclusion: learners are all different, some are more extroverted and others are more introverted, some have visual and other hearing problems; in any case, WhatsApp allows more introverted students to feel more comfortable participating, those who express themselves better through the written channel feel more confident, those who have visual limitations can access the material through voice messages or those who have hearing problems can read all content (Orijji & Onikpa, 2018).

Objectives of the study: The objectives of the study were to;

1. determine the extent to which respondents utilize WhatsApp Messenger;
2. discover the significance of WhatsApp Messenger and

3. determine the challenges the respondents faced in their usage of WhatsApp.

Methodology

Study Design: The study adopted a descriptive survey research design. A descriptive survey research design was adopted for the study. According to Nworgu (2015), a descriptive survey research design is one in which information is gathered from an unbiased representative group of interest using a questionnaire, interview, and observation. A descriptive survey design was found suitable for this study because data were collected from the respondents using a questionnaire. The study was carried out in Oyo State, Nigeria.

Population of Study: The population for the study comprised all the students of the Faculty of Science, The Polytechnic Ibadan and Faculty of Agricultural Extension, Home and Rural Economics, Oyo State College of Agriculture and Technology, Igboora, Oyo State (OYSCATECH) within the 2020/2021 academic session

Sample selection: The sample size for the study was a total of 150 undergraduate students comprising 100 students from the Polytechnic Ibadan and 50 students from OYSCATECH. The selection was done in multi-stages; first by randomly selecting 20% of the faculties in the schools. This gave one out of five faculties in the Ibadan Polytechnic and one out of seven faculties in OYSCATECH. The faculty selected were the Faculty of Science from Polytechnic Ibadan; the Faculty

of Agricultural Extension, Home and Rural Economics from OYECH. The next stage involved random selection of 10% of the student population in each faculty. Two departments were randomly selected from each faculty giving a total of four departments. The sample for each faculty was then randomly selected in equal proportion from the two selected departments. The selected participants comprised 70% females and 30% males within an average age range of 19- 22 years. 29.3% of the respondents are students with Higher National Diploma (HND) while 70.7% of the respondents are students with Ordinary National Diploma (OND). The majority (92%) were single; 45% of the respondents lived in the school hostels, 40% of the respondents lived off campus and 15% of the respondents came from home.

Instruments for data collection: A set of pre-validated survey questionnaires was used to obtain data for the study. The first section was structured to obtain data on the respondents' demographic characteristics such as gender, institution, and academic level. The second section was on the extent of WhatsApp usage by the respondents. It was rated on a five-point scale of Daily (5), weekly (4), fortnightly (3), monthly (2) and Never (1). The third section contained items that identified the significance of WhatsApp usage, it was measured on a 4-point rating scale of strongly agree (4), agree (3), disagree (2) and strongly disagree (1)

Validity and reliability test of the instrument: The questionnaire was subjected to face validation by three lecturers in the Department of Home and Rural Economics, Oyo State College of Agriculture and Technology, Igboora. Oyo State. Cronbach alpha technique was used to test the reliability of the instrument and a coefficient of 0.85 was obtained which indicates that the items of the instrument had high internal consistency.

Method of data collection: One hundred and fifty copies of the questionnaire were hand distributed to the respondents with the aid of two research assistants. The respondents filled out the questionnaires and they were collected back immediately. One hundred and fifty questionnaires were distributed, out of which 142 were successfully filled in and

returned; giving a response rate of 94.7%.

Data and statistical analysis: The data collected were analysed using SPSS version 23. Data on the extent to which respondents use WhatsApp Messenger were summarized in frequencies and percentages.

Results

The extent to which respondents utilize WhatsApp messenger

Table 1 shows the usage of WhatsApp by the respondents. Data show that all (100%) of them indicated that they use WhatsApp Messenger. The majority 69.7% used it daily; 16.2% used WhatsApp Messenger weekly, 7.7% of the respondents used WhatsApp Messenger fortnightly and 6.3% reported that they used it monthly.

Table 1: Usage of WhatsApp by Respondents

	Frequency	Per cent
Never	0	0.00
Daily	99	69.7
Weekly	23	16.2
Fortnightly	11	7.7
Monthly	9	6.3
Total	142	100.00

The significance of WhatsApp messenger

Table 2 shows data on the significance of WhatsApp Messenger to the respondents. From the table, many (%) of the respondents reported that WhatsApp messenger boosts students' performance; 21.3% of the

respondents noted that WhatsApp messenger is convenient and user-friendly; 17.61% of the respondents reported that WhatsApp is used in sharing documents relating to the courses that they were studying and 19.01% of the respondents reported that WhatsApp consumes fewer data.

Table 2: Significance of WhatsApp Messenger

S/N	Significance of WhatsApp Usages	Frequency	Per cent
1.	Boost students' performance	60	42.25
2.	Convenient and User friendly	30	21.13

3.	Sharing of Document	25	17.61
4.	Consume Less Data	27	19.01
	Total	142	100

Challenges students face in their usage of WhatsApp

Table 3 shows data on the challenges students face in their usage of WhatsApp (table 3) show the concerns and challenges the respondents encountered while using

WhatsApp. They included the high cost of internet connectivity (42.4%), lack of personal privacy (17.6%), irregular Internet access (19.7%), lack of time to use social media (10.5%) and lack of immediate personal benefits (9.8%).

Table 3: Challenges Students Face in their WhatsApp Usage

Challenges	Frequency	Per cent
Cost of internet	60	42.4
Lack of personal privacy	25	17.6
Irregular internet access	28	19.7
Lack of time to use social media	15	10.5
Lack of immediate personal benefits	14	9.8

Discussion

This study identified WhatsApp as one of the social media platforms used for learning in tertiary institutions. Findings from the study revealed that 69.7% of the respondents use WhatsApp Messenger daily. This is because such social media are commonly used by young people for interaction with their peers. The findings of this study are similar to that of Cheng and Qasim (2021) who found that there has been tremendous growth in the use of social media platforms such as WhatsApp, Instagram, and Facebook to facilitate learning. Chiang, et al., (2019) conducted a study and found that social media platforms like Facebook, Instagram, etc., have become a well-known communication and interaction channel among people worldwide.

This study also found that the majority of the respondents reported that WhatsApp boost their academic performance. This finding buttresses the findings of Abidin (2016) that it is easy to form groups with WhatsApp or to use it for private communication, it can be used to communicate anywhere and at any time, and it is commonly used by university students worldwide (Burke, 2002; Hofacket, 2001). Choshaly and Mirabolghasemi, (2020) found that WhatsApp was one of the most popular Social Network Sites (SNS) among students in tertiary institutions. Deng and He (2020) found that WhatsApp is popular among undergraduate students and that they use it daily. They also reported that students attributed their heavy use of WhatsApp to its ease of use, speed, real-time messaging, and low cost. WhatsApp can be used in

higher education in several ways to achieve different educational goals. However, Wang and Kim (2017) argued that WhatsApp can be used in higher education to create immediate connections, encourage reflection, and facilitate coordination in informal and formal learning.

The study also discovered the challenges faced by students in using WhatsApp Messenger for learning. The majority of the respondents lamented the cost of the internet. Chen (2018) found that WhatsApp was a useful electronic tool to facilitate information sharing among university students on a range of subjects related to the courses that they were studying. This confirms the findings of Chang and Chung (2014) who undertook a study whose aim was to establish the impact of messenger usage on students' performance in tertiary institutions in Ghana. Hemmi et al., (2009) have postulated that educators worldwide are seeing a lot of advantages in using social media such as WhatsApp to communicate with their students. They add that since students already collaborate, search for information, communicate and socialize via web technology as part of their everyday lives, there is no reason why they cannot use the same medium for learning purposes. Yeboah and Ewur (2014) assert that WhatsApp has been a necessary tool for students as it could enhance their performance, especially if it is used positively. This assertion is supported by Bouhnik and Deshen (2014) who state that WhatsApp has some academic

advantages as it enables quick transference of materials.

Conclusion

This study has explored the use of WhatsApp among students in selected tertiary institutions in Oyo state. WhatsApp usage among students was widespread. It was also used for learning purposes of conveying academic tasks such as assignment and tutorial questions, timetables and notices. WhatsApp was seen to be a user-friendly, cheap, and effective means of communication among students. However, users also pointed out some challenges they faced in their usage of WhatsApp which included lack of privacy, lack of security of personal information and irregular internet access.

Recommendations

The study recommended that tertiary institutions should give guidelines on the usage of WhatsApp so that students could take advantage of its viability and use it more for learning purposes. It also recommended that time management skills should be inculcated into students' curriculum so that they can prudently and productively use time as opposed to predominantly using WhatsApp for social interaction. The study further recommended that there is a need to advise students on the possible hazards of overusing internet accessories and applications such as WhatsApp.

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Sensory Attributes and Proximate Composition of Enriched Cookies Made from Blends of Maize, Millet and Crayfish

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Abstract

Food enrichment involves the addition of micronutrients to food to create a balanced and nutritious product with the outlook of providing essential nutrients. The study assessed the sensory attribute and proximate composition of enriched cookies made from blends of maize, millet and crayfish. three objectives guided the study. Descriptive survey and experimental design methods were adopted. The enriched cookies sample was varied into six major samples while the control comprised 100% maize. The sample product which was made with maize, millet and crayfish was coded according to the formulation ratio as follows; ABU₁(100:0:0), ABU₂(90:0:10), ABU₃(0:90:10), ABU₄(70:20:10), ABU₅(20:70:10), ABU₆ (30:60:10), ABU₇(60:30:10). Proximate composition of the seven cookies samples were assessed using standard methods. Sensory attributes were assessed using a 9-point hedonic scale and general perception of enriched cookies was assessed using a five-point Likert scale where the mean score of 3.00 was used as a cut-off to determine acceptable responses. The result of the proximate analysis showed that moisture content was significantly high in ABU₃ as compared to other samples. Protein content ranged from 1.43±0.04 to 7.03±0.03, also ABU₁ had the highest fat and carbohydrate content. The crude fibre content ranged from 1.97±0.01 to 2.68±0.10 while ash content was higher in ABU₃. Sensory attributes in the cookies sample showed that in terms of aroma and texture, the samples were not significantly different from one another but in terms of taste, they were different. The enriched cookie sample ABU₅ had the highest acceptability. Conclusively, moisture, protein, ash, fat, crude fibre and carbohydrate content of enriched cookies samples were within the normal range for cookies product. It is recommended that other protein-rich ingredients should be used to produce cookies for varieties and sustainable management of its consumers.

Keywords: Sensory attributes, nutrition, proximate composition, enriched cookies, blends.

Introduction

Good nutrition is critical for growth development and children. Malnutrition is a major public health problem, especially in developing countries. It can lead to stunted growth, cognitive impairment, weakened immune system and increased risk of infectious diseases. Various studies have been done on composite blends as a source of better nutrition for children and this inspires the use of the blends in snack products such as cookies that can offer more nutritive value to children thereby resulting in better growth and development. Most of the tropical snacks are based on cereals such as wheat. However, with the high cost of wheat in Nigeria, the use of indigenous crops such as maize and millet in flour blends for snacks needs to be explored.

Maize or corn belongs to the grass family known as *Poaceae* with its botanical name as *Zea mays* L. Maize is one of the most popular cereals crops, which is used for food, fodder and also for medical purposes in the world. More than 3,500 uses of corn products are identified by Huma et al. (2019). Maize products are also a good source of vitamins A, B, and E, and many minerals. It has reduced hypertension and prevented neural-tube defects at birth. According to Hossain et al. (2016), mankind has always utilized crops for its development and survival; achieving nutrition, economic, industrial, and research values from crops. Maize is one of the three most explored food crops by mankind in addition to rice and wheat, owing to the high value

derived from the crop. Agba (2016) opined that maize exploration has been high from its point of origin in the Central American tropics and Mexico to all parts of the globe, with its uses/utilization doubling as the day counts.

Millet is another cereal food that is gaining popularity globally. A study conducted by Kumar et al. (2018) asserted that millet has been used for food and feed from ancient times and has been a staple food, particularly in the diets of African and Asian people. These are consumed as flatbread, porridge, roasted and alcoholic and non-alcoholic beverages. Nigeria uses millions of tons of pearl millet as a staple food, especially in Northern Nigeria. According to Izge et al. (2013), millet is used in making a popular fried cake known as "masa". Its flour is also used in preparing "tuwo", a thick binding paste, also referred to as "toh" in northern Africa. It contains 18% protein, rich in vitamin B, especially niacin, B6 and folic acid. Food enrichment involves the addition of micronutrients to food to create a balanced and nutritious product with the outlook of providing essential nutrients (Nwadi et al., 2020).

Although cereal foods are rich in nutrients and provide bulk meals, they do not adequately contain some of the essential nutrients such as protein and minerals, therefore, there is a need for their products to be enriched with high protein sources such as crayfish. Enrichment of snack products can come in the form of blends designed to provide a range of essential nutrients such as protein,

vitamins, minerals, fibre and antioxidants in a convenient and accessible form (Oyeyinka et al., 2018). One benefit of enrichment in nutrition is that it offers versatility and flexibility in meeting individual nutritional requirements.

Crayfish are crustaceans that are also known as crawdads, crawfish, freshwater lobsters, mountain lobsters, mudbugs, or yabbies (Iwar & Amu, 2021). They are closely related to lobsters, crabs, and shrimp. Crayfish are eaten worldwide like other edible crustaceans. It is usually prepared for consumption by smoking, and occasionally preserved by sun-drying, and is a common delicacy in the diet, among the people of Southern and Western – Nigeria. Moreover, it may also be available in all seasons, affordable and suitable to supply essential nutrients to meet infants' estimated daily nutrient requirements to eradicate malnutrition in developing countries (Adegbusi et al., 2023). Crayfish is classified as an animal polypeptide source, accounts for 36-45 per cent of crude protein, and is a freshwater crustacean. It was reported to have high nutritive value with a superior biological value, true digestibility, net protein utilization, and high content of essential amino acids (Ahmad, et al., 2013).

In rural areas, homemade foods tend to be from a single class of nutrients, which is of low nutritional quality resulting in inadequate feeding which is one of the major causes of malnutrition (UNICEF, 2019). Due to the high cost of processed foods, the low-income

families within the Ilorin metropolis, end up feeding their children with unfortified cereal-based foods such as maize gruel (ogi) since it is cheap and affordable. However, it lacks the essential nutrients needed for healthy growth. Unfortified cereal-only formulations based on maize, millet or guinea corn are relatively poor in energy and protein density, which usually leads to protein-energy malnutrition (PEM) in infants. Adding a fortified snack to children's meals might be an effective strategy to enhance their nutrient intake. This is because children tend to have more appetite for ready-to-eat snacks (for example cookies and biscuits), and this can be formulated using a blend of cereals and legumes to ensure the provision of essential nutrients needed for healthy growth.

A cookie is a baked or cooked snack or dessert that is typically small, flat and sweet. It usually contains flour, sugar, egg, and some type of oil, fat, or butter. Ajibola et al. (2015) stated that cookies are popular examples of bakery products of ready-to-eat snacks that possess several attractive features including soft texture, convenience, long shelf-life and the ability to serve as vehicles for important nutrients. According to Farheena, et al. (2015), cookies and other bakery products have become loved fast-food products for every age group, because they are easy to carry about, tasty to eat, cholesterol-free, and contain dietary fibre that allows digestibility. Awolu et al. (2016) stated that the enriching cookie helps to improve its nutritional and functional quality. In this regard, the

study focused on the production of cookies from the combination of maize flour, and millet flour enriched with crayfish for the sole aim of improving children's nutrition.

The Objectives of the Study: The objectives of the study were to;

- i. Produce enriched cookies using different ratios of maize, millet and crayfish flour blends;
- ii. determine the proximate composition of enriched cookies;
- iii. determine sensory attributes and acceptability of produced cookies and
- iv. evaluate the general perception of enriched cookies.

Materials and Methods

Design of the study: The study adopted a quasi-experimental design. A quasi-experimental design was considered appropriate for the study because there was no randomization carried out.

Procurement of raw materials: The raw materials used for the production of cookies were flour made from yellow maize (*Zea mays*), millet (*Pennisetum glaucum*) and crayfish (*Palaemon hastatus*). These items were procured from a local (Ipata) market in Ilorin South Local Government Area, Kwara State, Nigeria.

Blend formulation: To determine acceptable levels of cookies made from the blend of maize, millet and crayfish flour, seven products were formulated, each sample weighing 125g. and 100% maize sample was used as the control.

yellow maize/millet

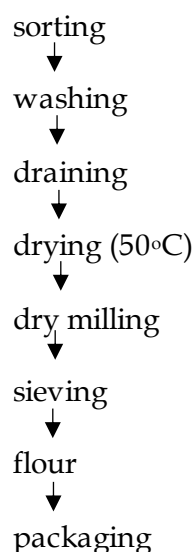


Figure 1. Flow chart of the blend formulation

Cookies production: Cookies were produced using Peter *et al.* (2017) method with a slight modification.

Ingredients	Quantities
Flour	125g
Butter	50g
Sugar	50g cup
Vanilla Essence	1 teaspoon
Baking powder	1 teaspoon
Salt	½ teaspoon
Milk	⅓ cup (31 ml)
Egg	One medium-sized
Nutmeg	½ teaspoon

Procedure:

- Flour was measured into a bowl with the use of the rubbing-in method, butter, nutmeg, salt and baking powder were added and rubbed for 30 minutes.

- In a separate bowl, egg, milk, vanilla and sugar were mixed into the flour-based mixture and kneaded to make a dough.
- The dough was then picked in bits at a weight of 10g, rolled out and then placed on the greased pan with a fork to give its flat circular shape.
- The dough was then baked at 150°C for 30 minutes in the oven.
- After baking the cookies, it was allowed to cool down to room temperature then packed in low-density polyethylene (LPDE) bags and sealed in a plastic transparent container.

Method and Instrument of Data Collection

Sensory evaluation: The organoleptic test of the cookies was done using a 9-point hedonic scale. The panellists comprised thirty (30) healthcare professionals from the University Teaching Hospital of Nigeria, Ilorin. This group of people were selected as panellists because we believe they could provide objective opinions on enriched snacks. Each attribute was rated according to its intensity scaled on a 9-point hedonic scale quality with 9 = Like extremely, 8 = Like very much, 7 = Like moderately, 6 = Like slightly, 5 = Neither like nor dislike, 4 = Dislike slightly, 3 = Dislike moderately, 2 = Dislike very much and 1 = dislike extremely to test for appearance/colour, aroma, taste and mouthfeel. The product was served in a white bowl, and the tasting for each product was done after rinsing out mouth. The overall acceptability of the product was determined. They also rated their general perception of

enriched cookies using a 5-point Likert scale. The response options were strongly agreed (5), agreed (4), undecided (3), disagree (2) and strongly disagree (1).

Proximate analysis: The proximate composition of samples of cookies was determined using the method described by the Association of Official Analytical Chemists of AOAC. The protein content was done by the Kjeldahl method recommended by AOAC, (2000). The moisture, crude fibre, ash, fat and carbohydrate content was done by the method described by AOAC (2005).

Statistical analysis: Data were analyzed using descriptive statistics such as percentages, frequencies, mean and standard deviation, and inferential statistics. The mean cut-off for the general perception of enriched cookies was 3.00. An item with a mean ≥ 3.00 was accepted. Analysis of Variance (ANOVA) was used to test for significant differences in the acceptability of cookies in varying proportions. The significant level was accepted at $p < 0.05$.

Results

The socio-demographic characteristics of healthcare professionals in selected hospital shows that the majority of the respondents were females (90%) while (10%) were male, their occupation were doctors (46.70%), Nurses (13.30%), Dieticians (16.70%) and Surgeons (23.30%) which is reflected in their level of education as (83.30%) had tertiary education while (16.70%) had secondary school education. Also, their monthly

income ranged between ₦30,000-₦40,000 (46.70%), while 53.30% had an income above ₦40,000.

Formulated flour blends

Table 1 shows the flour blends that were formulated according to various ratios as follows; ABU₁:(maize-100%, millet-0%, crayfish-0%) which served as the control, ABU₂:(maize-90%,

millet-0%, crayfish-10%), ABU₃:(maize-0%, millet-90%, crayfish-10%), ABU₄:(maize-70%, millet-20%, crayfish-10%), ABU₅:(maize-20%, millet-70%, crayfish-10%), ABU₆:(maize-30%, millet-60%, crayfish-10%) and ABU₇:(maize-60%, millet-30%, crayfish-10%).

Table 1: Blending ratio of flour used in the production of cookies

Proportion of blend ratio (%)			
Sample Code	Maize flour	Millet flour	Crayfish
ABU ₁ *	100	0	0
ABU ₂	90	0	10
ABU ₃	0	90	10
ABU ₄	70	20	10
ABU ₅	20	70	10
ABU ₆	30	60	10
ABU ₇	60	30	10

Key: *; control flour blend; ABU stands for maize, millet & crayfish sample

Proximate composition of enriched cookies

The proximate composition of cookie samples was presented as means and the standard deviation was shown in Table 2. The moisture content of enriched cookies ranged from 4.40%-5.44% but was not significantly different from one another, with ABU₃ (5.44±.00^a) having the highest mean. The protein content of cookies increased significantly as compared to the control, having ABU₆ with the

highest content of 1.88±.01^a. Ash and crude fibre content of all other enriched cookies samples had a higher content as compared to the control except for ABU₆ (ash-1.95±.05^c; crude fibre-1.97±.01^a) that had low content. The fat and carbohydrate content of the enriched cookies significantly decreased with the addition of millet and crayfish as compared with the control and were significantly different.

Table 2: Proximate composition of enriched cookies made from blends of maize, millet and crayfish (125g weight)

Samples	Moisture%	Protein%	Ash%	Fat%	Crude fibre%	Carbohydrate%
ABU ₁ *	4.54±.00 ^a	1.01±.04 ^b	1.47±.00 ^a	8.12±.00 ^b	2.04±.04 ^{ab}	7.57±.04 ^g
ABU ₂	5.02±.00 ^a	1.43±.01 ^c	2.26±.02 ^d	1.62±.00 ^g	2.17±.00 ^{ab}	6.00±.00 ^e

ABU ₃	5.44±.00 ^a	1.73±.04 ^e	2.27±.00 ^d	1.52±.07 ^d	2.14±.01 ^{ab}	5.76±.16 ^b
ABU ₄	5.25±.00 ^a	1.83±.05 ^f	2.18±.03 ^c	1.62±.06 ^d	2.24±.04 ^{ab}	5.59±.19 ^a
ABU ₅	4.40±.00 ^a	1.69±.00 ^d	2.26±.01 ^d	1.62±.01 ^f	2.68±.10 ^c	5.83±.09 ^d
ABU ₆	5.09±.00 ^a	1.88±.01 ^a	1.95±.05 ^b	1.55±.01 ^e	1.97±.01 ^a	5.61±.03 ^a
ABU ₇	5.21±.00 ^a	1.51±.04 ^f	2.22±.01 ^{cd}	1.44±.06 ^c	2.36±.42 ^{bc}	5.79±.09 ^c

Key: *; control flour blend; ABU stands for maize, millet & crayfish sample

Values are mean ± SD, values with different superscripts along a column are significantly different (p<0.05)

Sensory attributes and acceptability of enriched cookies

The sensory attribute scores (colour, aroma, mouthfeel, taste and general acceptability) of cookies are presented in Table 3. The cookies sample, in terms of colour, was statistically different; the control ABU₁ (8.79±0.00^a) had better colour compared to the enriched samples. In terms of aroma and mouthfeel, the samples were not statistically different, the control sample had better aroma followed by ABU₄

(8.68±0.24^a) also, for mouthfeel, the control was better followed by ABU₇ (7.55±0.00^a). In terms of taste, the cookies samples were statistically different ABU₅ (9.00±0.24^b) had better taste as compared to the control. For general acceptability, the cookies samples were significantly different from one another where ABU₅ (8.95±0.05^a) had higher acceptability followed by ABU₁ (8.26±1.02^a) while ABU₃ (6.18±0.03^c) had the lowest acceptability.

Table 3: Sensory attributes of enriched cookies made from blends of maize, millet and crayfish

Samples	Colour	Aroma	Mouthfeel	Taste	Overall acceptability
ABU ₁ *	8.79±0.00 ^a	9.00±0.68 ^a	8.59±0.05 ^a	6.03±0.99 ^a	8.26±1.02 ^a
ABU ₂	7.61±0.03 ^c	7.17±0.00 ^a	6.18±0.03 ^a	8.35±0.99 ^a	7.27±1.00 ^b
ABU ₃	6.59±0.19 ^a	6.24±1.06 ^a	6.27±0.02 ^a	5.69±0.00 ^a	6.18±0.03 ^c
ABU ₄	6.85±1.23 ^a	8.68±0.24 ^a	6.30±1.90 ^a	6.40±2.28 ^a	6.90±1.83 ^b
ABU ₅	8.00±0.00 ^b	8.36±0.10 ^a	7.26±0.25 ^a	9.00±0.24 ^b	8.95±0.05 ^a
ABU ₆	7.57±0.04 ^a	7.55±0.01 ^a	7.47±0.00 ^a	7.51±0.05 ^b	7.22±0.02 ^b
ABU ₇	7.50±0.50 ^a	6.52±0.06 ^a	7.55±0.00 ^a	6.51±0.00 ^a	7.00±0.00 ^b

Key: *; control flour blend; ABU stands for maize, millet & crayfish sample

Mean ± SD. with different superscripts along a column are significantly different (P≤0.05).

The general perception of enriched cookies produced the blends of maize, millet and crayfish

The general perception of enriched cookies is presented in Table 4. The panellists agreed that enriched

cookies can be sold in the local market (\bar{x} =4.33), the price of enriched cookies can be relatively affordable (\bar{x} =4.23), they will recommend enriched cookies to other families (\bar{x} =4.17), enriched cookies can easily be

preserved ($\bar{x}=4.13$), and enriched cookies can be purchased by everyone ($\bar{x}=3.93$). The panellists did not agree with the item; "I feel people are willing to learn how to prepare enriched cookies ($\bar{x}=2.45$)".

Table 4: Perception of healthcare professionals on enriched cookies made from blends of maize, millet and crayfish

Statements	(\bar{x})	SD	Remark
I think enriched cookies can be sold in the local market	4.33	3.80	Agreed
I feel enriched cookies can be purchased by everyone	3.93	3.50	Agreed
I think the price of enriched cookies can be relatively affordable	4.23	4.10	Agreed
I think the prices of these cookies are relatively moderate based on their contents	3.90	3.86	Agreed
Enriched cookies will be easier to produce	3.56	3.00	Agreed
I will recommend enriched cookies to other families if made available	4.17	3.23	Agreed
I feel enriched cookies will not have a long shelf-life due to their contents.	3.97	3.70	Agreed
I think enriched cookies if exposed to air will lose their taste	3.10	4.00	Agreed
I think enriched cookies can always be packaged to avoid external contamination	3.23		Agreed
Enriched cookies can easily be preserved	4.13	3.20	Agreed
I think the enriched cookies can always be sealed with durable material to avoid spoilage	3.53	3.00	Agreed
I feel children should be the major consumers of enriched cookies	3.12	3.12	Agreed
Enriched cookies ingredients are readily available in the local market	3.12	3.00	Agreed
Enriched cookies ingredients are easily accessible in the local market	3.45	3.24	Agreed
I feel people are willing to learn how to prepare enriched cookies	2.45	2.20	Disagreed
Enriched cookies are produced to improve children's appetite	3.01	3.36	Agreed
Grand mean	3.58		

Discussion

The study assessed the sensory attributes and proximate composition of enriched cookies made from blends of maize, millet and crayfish. The proximate composition of enriched cookie samples varied significantly from one another. The moisture content of the cookies sample made from 90% millet and 10% crayfish was

higher than the others. The high moisture content in the sample might be due to the physical properties of finger millet which is one of the ingredients used in the production of enriched cookies. However, the moisture content of the samples is within the normal range, this agrees with the study of Ramashia et al. (2017), who opined that the moisture

content of finger millet grain ranges from 7.88 to 9.38% while their flour moisture content can range from 9.17 to 11.6% respectively. The higher the moisture content of the flour, the shorter the storage life, which can cause the rapid growth of mould (Abdullah et al., 2012).

The protein content of enriched cookies ranges from 1.01% to 1.83% which is relatively low. This may be attributable to the type of grains used in the production of the enriched cookies sample. This disagrees with the study that reported that the minimum level of protein in cookie products should be 5% (Nugraheni et al, 2019). The cookie sample with 100% maize which served as the control had a high fat and carbohydrate content which was reduced as the percentage inclusion of millet and crayfish increased. According to Amadi (2019), the addition of other flour products with low-level carbohydrates and fat may be attributable to the reduction in carbohydrate content in the enriched cookies samples. Also, crude fibre and ash content in the enriched cookies increased on the percentage inclusion of millet and crayfish, this indicates that the mineral and dietary fibre content in the enriched cookies is high. Igbabul et al (2019) reported that cookie products are high in dietary fibre and enhance gastrointestinal health.

The sensory properties of enriched cookies produced from blends of maize, millet and crayfish; this attribute has a high sensory rating in all samples evaluated at a significant level ($p < 0.05$). The colour,

aroma and mouthfeel of the control cookies sample (100% maize) had higher means, this might be resulting from been use of cookies made from maize composite flour, Awotadeju and Olapade, (2020) reported in their study on wheat-maize cookies that the control sample ranked the highest among the other presented samples. For taste, the enriched cookies sample with 20% maize, 70% millet and 10% crayfish (ABU₅) had the higher mean, this can be a result of preferences as taste is an important parameter in product formulation. Also, the sample ABU₅ was generally accepted better than the control and other enriched cookies samples. This contradicted the study of Ani and Okoye (2021) who reported that the colour, taste, aroma and general acceptability of cookies product increased at different levels of substitution with other ingredients made with cookies.

Healthcare professionals' perception of enriched cookies was positive. This reveals that the product can be introduced in the local market especially the enriched cookies sample with 20% maize, 70% millet and 10% crayfish which had a high general acceptability. Also, the products can be made available and affordable to encourage consumers to purchase them. In addition, attention can be paid to the packaging to preserve its taste and allow a longer shelf life. This is justified in the study by Tarrega et al. (2017), which reported that the perception of consumers on food products with cookies as a case study, positive values placed on products such as

healthiness, familiarity and affordability can motivate acceptance of products.

Conclusion

Enriched cookies from blends of maize, millet and crayfish are generally accepted. The study concluded that the enriched cookies sample of 20% maize, 70% millet and 10% crayfish (ABU₅) was preferred over other samples. The enriched cookies showed that the moisture, protein, ash, fat, crude fibre and carbohydrate content are within the normal range which indicates that enriched cookies are good for consumption. The increased ash and crude fibre content serve as a great value for cookie enrichment as it enhances gastrointestinal health and improves the nutrition of its consumers. Enriched cookie samples had a positive outlook concerning acceptability, thus this product can be made available in local markets at affordable prices to consumers.

Recommendations

Based on the findings of the study the following recommendations were made,

1. Millet-maize cookies should be enriched with other protein-rich ingredients to increase the protein value of the cookie products.
2. Enriched cookies sample can be recommended by healthcare professionals for use as a healthful snack for consumers and the general public.

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Micronutrients of Importance in the First 1000 Days of Children's Cognitive Development for Sustainable Educational and Career Development

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Abstract

The paper reviewed the micronutrients that are required for cognitive development in the first 1000 days of life which refers to the period from conception of a child to the second birthday. Cognitive development refers to the growth and progression of children's ability to learn, reason, think and solve problems. During this period, the brain undergoes rapid development that is dependent on adequate nutrition, particularly micronutrients which include iron, iodine, zinc, folates, Vitamin B₁₂ and Vitamin A among other dietary components. Micronutrients are crucial for children's cognitive development because they give structural and functional advantages to the brain and central nervous system during their formative years. The deficiency or inadequate consumption of these micronutrients especially during the critical stage of brain formation, could lead to structural and functional damage to the brain and delayed or non-acquisition of cognitive competencies needed for future educational and career successes. Brain deformation arising from micronutrient deficiency may be reversible or permanent. Micronutrient deficiencies could be prevented through adequate consumption of micronutrients during pregnancy, exclusive breastfeeding in the first six months of life and introduction of adequate complementary feeding with varieties and fortified foods after six months with continued breastfeeding for 2 years of the child's life and good nutrition knowledge of mothers through Nutrition Education. It is recommended that pregnant women should be exposed to knowledge of adequate infant and childhood nutrition, care and practices that promote micronutrient intake for mothers and children so that they intentionally consume meals high in vitamins and minerals.

Keywords: Micronutrients; Children; First 1000 days; Cognitive development; Nutrient deficiency

Introduction

Early childhood nutrition plays a critical role in shaping the child's cognitive development. The first 1000 years of an individual begin at conception and run through the second birthday of the person. During this period, the brain goes through the fastest growth and development which forms the foundation for its reaching its optimum development. This optimum development is dependent on the consumption of micronutrients and others, dietary components. Micronutrients are vitamins and minerals needed in very small quantities in the human body to ensure optimal growth, development, disease prevention and well-being (Partnership for Child Development (PCD), 2019; Centre for Disease Control and Prevention (CDCP), 2018). Some of these micronutrients may be produced in the body while others are found in foods. Iron, iodine, zinc, calcium, vitamin A, and B vitamins are not produced in the human body, therefore must be consumed through food (CDCP, 2018). Studies have shown that these nutrients affect brain growth and neurodevelopment both during the prenatal stage of life and during childhood (Benton, 2008). They also act as coenzymes or form structural parts of the enzymes required for metabolic activities and therefore need to be in regular supply to the brain (Swaminathan et al., 2013).

It has been established that at this formative period of 1000 days of a child's life, nutrient deficiency or inadequacy can have a long-term effect on health and wellbeing. Folic

acid, vitamin A, iron and iodine have been reported to be the most important micronutrients for the foetus (Bird (2016), as they aid in the proliferation of the cells of the hippocampus, the left temporal lobe and the prefrontal cortex parts of the brain. These parts of the brain are responsible for encoding and retrieval of memories; acquisition and understanding of language, as well as higher-order cognitive functioning such as problem-solving (Benton, 2012). These attributes are essential for smooth learning, educational development and career success.

The global prevalence of deficiency in at least one of three micronutrients has been estimated to be 56% (372 million) among preschool-aged children and 69% (12 billion) among non-pregnant women of reproductive age (Stevens et al., 2022). According to their study, three-quarters of preschool-aged children with micronutrient deficiencies live in East Asia, South Asia and Sub-Saharan Africa. Deficiency of micronutrients interferes with early brain development in two ways; by limiting the formation of myelin sheaths, dendrites and synapses and by altering the tissue levels of neurotransmitters such as dopamine and serotonin. These result in structural and functional changes in the neurons. This shows that the deficiencies of specific micronutrients have a detrimental impact on children's cognitive processes and functions, resulting in a negative shift in the intelligence quotient (IQ) potential of children (Khor and Misra, 2012). It is therefore imperative to

note that from conception, the consumption of adequate micronutrient-rich foods should be a priority for pregnant mothers and children under two years of age to ensure that the components of the brain are all developed to their full potential to reduce cases of learning difficulties in schools arising from low cognitive potentials and capacities of the children.

Concept of Cognitive Development

Cognition, according to Nyaradi, Li, Hickling, Foster and Oddy (2015) represents a complex set of higher mental functions of the brain such as attention, memory, thinking, learning and perception. Cognition, just like every other aspect of the human functional domains, progresses in capabilities of functioning, as individuals' brains develop across lifespan. Brain development starts at conception and continues across middle childhood and into the adult years. It begins with the formation of brain cells, followed by cell migration and differentiation, and the development of synapses to enable cells to communicate with one another (Black, 2008). Siegler (2019), described cognitive development as the advancement in mental processes such as perceiving objects and events in the environment, acting skillfully on objects to obtain goals, understanding and producing language, problem-solving, reasoning, creating, conceptualizing, categorizing, remembering and planning. It involves changes in the way humans think and process information received from the

environment. Lam and Lawlis (2016) explained that an adequate micronutrient supply is a necessary stimulation required by the brain, as their deficiencies have been linked to impaired cognition in children.

The first 1000 days (that is, from conception to 2 years of age) according to Prado et al. (2017) are a critical period for cognitive development as it can have long-term effects on brain architecture and cognitive ability. This is when neurons and myelin are formed at a rapid rate to shape the foundation for future cognitive health and function. The myelination of the brain as stated by Winje et al. (2018) is of importance for multiple brain systems and is highly related to neurodevelopment and subsequent cognitive functioning. According to Nyaradi et al. (2015) cognitive development at this time predicts an individual's school achievement in the later years. Academic achievement on the other hand is of significant concern because it is important for future personal health, wealth and well-being.

Micronutrients Deficiencies (MNDs) and Children's Cognitive Development

In the first 1000 days beginning from conception to two years of age, micronutrients play critical and significant roles in both body growth and the cognitive development of children which may determine their learning abilities, educational development and future career in adulthood. During this period, which is critical as the brain undergoes rapid growth and development, adequate

intake of all the essential nutrition is required to support this growth and development process. The nourishment of the foetus during gestation and the infant after birth is the sole responsibility of the mother through feeding during pregnancy and breastfeeding/complementary feeding after birth. These micronutrients include iron, iodine, folic acid, zinc, vitamin A and the B complex vitamins. Micronutrient deficiencies (MNDs) are commonly associated with chronic hunger and specific dietary deficits (PCD, 2019). It was reported by Khor and Misra (2012) to be generally correlated with overall undernutrition, particularly in poor households where poverty limits the quantity and quality of dietary intake. Iron, iodine, folate, vitamin A, and zinc deficiencies are the most widespread MNDs, and all are common contributors to poor growth, intellectual impairments, perinatal complications, and increased risk of morbidity and mortality (Khor & Misra, 2012). Brain growth is very rapid during the first 1000 days of life and micronutrient deficiencies at this stage can alter the pattern of central nervous system development and hence, interfere with the acquisition of cognitive skills (Black, 2008). According to Thompson and Nelson (2001), the structural and functional development of the human brain starts at conception with the formation of the neural tubes, followed by the generation, proliferation, migration and differentiation of the neurons; after which the formation of myelin and

synapses begin at the last trimester. Myelin is the protective fatty tissue which facilitates the exchange of nerve impulses; therefore, as stated by Black (2008), any impediment to the myelination of the brain cells prenatally or during infancy could lead to delayed acquisition of cognitive skills. During gestation, micronutrients, are transferred from the mother to the foetus through the placenta, therefore the requirements of the foetus is factored in the recommended intakes of the pregnant mother, while infants obtain their micronutrient requirements through breastmilk, and/or natural and fortified complementary foods.

Specific Micronutrients and Cognitive Development

Iron is necessary for haemoglobin formation, which carries oxygen in red blood cells to the brain and all other parts of the body (Centre for Disease Control (CDC), 2019). It is responsible for the proper development of the brain cells that produce myelin (Khor and Misra (2012). It, therefore, aids myelination and development of various parts of the brain, which occur rapidly from the last trimester of pregnancy to about 2 years of the life of the child (Cerami, 2017). Iron is also associated with the enzymes necessary for synthesizing neurotransmitters, production of energy and brain regulation (Nyaradi et al., 2015). Eighty per cent of the iron present in a full-term born baby is accumulated during the third trimester of pregnancy, this may be the reason why preterm babies are usually

deficient in total body iron (American Academy of Pediatrics, 2010). Different recommendations have been made for an increase in the iron requirement of pregnant mothers. This explains why iron supplements are essential for mothers attending Ante-natal Clinics during pregnancy in Nigerian Primary Health Care Clinics as standard practice. Children obtain iron from breast milk and or infant formula, heme iron (animal food sources), and non-heme iron obtained from plant food sources (Carter et al., 2011). Breastmilk is a poor source of iron (35 mg/L) however, Domello, et al., (2014) explained that the iron in breastmilk is enough for the neonates because there are sufficient stores of iron in the body of newborns which usually lasts for about 4-6 months of life (Bothwell, 2000). However, as babies grow older, the iron stores deplete, warranting a daily iron supplementation from four months for the full-term infant (CDC, 2019a).

Iron deficiency is a major cause of anaemia in addition to malaria, injuries and parasite infestations. Iron deficiency during fetal development and the first 2 years of life is associated with poor growth and decreases in cognitive development (Cerami, 2017). Several observational studies reported by Bryan et al. (2004) found that children who experienced iron deficiency anaemia before age two continued to demonstrate lower academic performance during their school-age years, even after the anaemia had been treated. In a similar study in Michigan, USA on infants between 9-10 months, Carter et al.

(2011) observed that infants who had iron deficiency anaemia performed less than children without iron deficiency anaemia on cognitive tests of object permanence and recognition memory. Carter et al. (2011) in another review of the findings of thirteen studies across Europe, Asia and Africa, concluded that infants with iron deficiency anaemia showed persistently lower cognitive test scores than normal infants. These studies have shown that iron is an essential nutrient in brain development to ensure that children do not grow up with learning difficulties which could hamper their educational development,

Iodine is another one of the most important minerals required by a fetus for brain and cognitive development (CDCP, 2018). The production of the thyroid hormones (Thyronine T3 and Thyroxine T4) that facilitate the maturation of the central nervous system for faster transmission of nerve impulses from the brain to the parts of the body is dependent on iodine. According to John, Black and Nelson (2017), The thyroid gland requires about 60 µg of iodine per day to produce an adequate supply of these hormones. Studies have established the link between poor dietary intake of iodine and incidences of cognitive retardation (WHO 2020^b). John et al. (2017) observed that mild to moderate deficiency of iodine is associated with cognitive delays which can lead to academic setbacks while severe deficiency can lead to intellectual disability. Prado et al. (2017) reported a similar study in China which

revealed that children whose mothers lived in iodine-deficient areas had 12.5 points lower in IQ tests, compared to those whose mothers were living in iodine-sufficient locations. Therefore, iodine is a vital micronutrient to ensure optimal brain growth and development which is a pre-requisite for the attainment of academic success.

Zinc is a mineral that promotes immunity, resistance to infection, and proper growth and development of the nervous system (CDC, 2018). The role of zinc in brain development and function is the formation of neurons, migration, and synapse generation (John et al., 2017; Khodashenas et al., 2015). Zinc aids learning and memory by modulating the intracellular and intercellular neuronal signalling of the hippocampus (Warthon-Medina et al., (2015). Learning and memory are important characteristics needed for intellectual and academic success in school, so the deficiency of zinc in these early stages of life of children could affect attention leading to memory loss and ultimately impairing the ability to learn. Warthon-Medina et al. (2015) reported a study in which zinc supplements were given to children from 12 to 35 months; a follow-up on the children at 7-9 years of age showed significant improvements in intellectual function scores among the group that received zinc supplement, compared with the placebo control group. Benton (2008) also reported that a study of Egyptian infants showed that low zinc status was associated with poor attention.

Folate or folic acid, also known as vitamin B₉ or folacin are naturally occurring in foods or artificially incorporated in vitamin supplements. Folic acid is crucial for proper brain functioning; it plays an important role in mental health and the production of the body's genetic material, DNA and RNA. According to CDC (2018), folic acid is essential in the earliest days of brain and spinal cord development. Studies reported by Campoy et al. (2015) showed improved neurodevelopment in infants of folate-supplemented mothers. This implies that folates are indispensable for rapid cell growth and proliferation during brain development. Bird (2016) observed that if pregnant women are folate deficient in the first 3-5 weeks of pregnancy, their fetus is at risk of Neural Tube Defects (NTDs). NTDs are a result of incomplete closure of the neural tube commonly manifesting in the forms of *spina bifida*, (a condition in which a portion of the spinal cord and the surrounding structures develop outside instead of inside the body) and *anencephaly* (a condition in which the brain and skull bones do not form properly and results in parts of the brain being absent) (Stanford Children Health, 2020). Therefore, folate is essential to prevent NTDs.

Vitamin B₁₂ or cobalamin like iron, plays an important role in neural myelination, synaptogenesis, and neurotransmitter synthesis, with potential effects on cognitive development and ultimate cognitive functioning of children (Venkatramanan et al., 2016). Infants

need vitamin B12 for supporting brain development and producing healthy red blood cells. Folates (folic acid) and vitamin B₁₂ are often considered as a pair so deficiencies in one vitamin may alter the metabolism of the other (Mahmood, 20140). Pacholok (2014) observed that the deficiency of Vitamin B₁₂ in infants and children is not easily diagnosed because the signs and symptoms often mimic those of autism spectrum disorders such as obsessive-compulsive behaviours, and difficulty with speech, language, writing and comprehension. When accurate treatment is not initiated early enough, the children are at risk of irreversible brain damage leading to retarded cognitive and language development (Pacholok, 2014). Poor vitamin B₁₂ status is common among young children in low and middle-income countries (Kvestad et al., 2015), which unfortunately includes Nigeria. In a cohort study among North Indian infants, Kvestad et al., (2015) reported that marginal vitamin B₁₂ status was associated with lower scores on the mental development index of the Bayley Scales of Infant and Toddler Development. In another study by Benton 2012, a 14-month-old baby with severe brain atrophy as a result of vitamin B₁₂ deficiency was found to have normal brain waves after six weeks of supplementation. However, a follow-up observation at 2 years of age showed that cognitive and language development remained seriously retarded. This suggests that Vitamin B₁₂ deficiency in infancy could have negative lasting

consequences on the academic success of children

Vitamin A or Retinol is necessary for healthy eyesight and immune system functions (CDC, 2018). It is also very key during foetal growth and development and particularly crucial during the development of the central nervous system (Ransom et al., 2014). It plays a critical role in visual perception, hence deficiency of vitamin A is the leading cause of childhood blindness in developing countries (Benton, 2012). Deficient children are at an increased risk of appetite loss, eye problems, lower resistance to infection, iron deficiency anaemia, growth failure and death (Centers for Disease Control and Prevention, 2018). Old and recent studies have linked vitamin A to cognitive performance in children. Among these studies is that of Ali et al. (2017) where it was established that children who received prenatal and childhood vitamin A supplementation had significantly better performance in reading, spelling, and math computation compared with the control group. Vitamin A has also been directly linked to the proper absorption of iron, its metabolism and storage in the body (Gropper and Smith, 2013, Ip et.al., 2017)). Indicating that these two vitamins are dependent on each other to function optimally.

Prevention and Intervention Programmes for Childhood Micronutrient Deficiency

Micronutrient deficiency is a global public health issue, especially in developing countries of the world.

UNICEF (2018) identified the strategies to prevent and treat micronutrient deficiencies in women and children to include dietary diversification, food fortification, supplementation, Nutrition Education of women of childbearing age and prevention and treatment of infectious diseases, and deworming. The promotion and support of exclusive breastfeeding (Scherbaum, 2016) and adequate complementary feeding plus immunization of children in the first year against childhood killer diseases is also a major strategy to prevent micronutrient deficiencies in infants and children.

Dietary diversification in this context involves getting all micronutrients by consuming a variety of foods from multiple sources (both plant and animal food sources) and these foods should be sufficient in quality and quantity (Nair et al., 2016; WHO 2020^a). Dietary diversification is a long-term strategy aimed at changing household diet through social and behaviour change activities, increased production of nutrient-rich foods and improved access to diverse foods. It is a nutrition intervention strategy targeted at a wider population to prevent micronutrient deficiency at the household level. This strategy if properly applied will help ensure sustainable micronutrient intake by both the pregnant mothers and infants after birth.

Food fortification has been identified by the World Health Organization (WHO),

the Copenhagen Consensus and the Food and Agriculture Organization (FAO) as one of the top four strategies for decreasing micronutrient malnutrition at the global level (National Institute of Health, 2020). It involves deliberately adding essential vitamins and minerals to foods during processing, to improve the nutritional quality of the food supply and provide a public health benefit with minimal risk to health (WHO & FAO, 2006). Salt, staple cereals such as wheat, corn, rice, sugar, vegetable oils, bouillon cubes, and other condiments are commonly fortified foods available in the markets, (National Institute of Health, 2020; (Anjorin et al., 2019)) especially in Nigeria. Salt is fortified with iodine, oils and sugar with vitamin A, bouillon cubes/powders with iron and cereals with the B Complex vitamins. This is so because these foods are staples and commonly consumed in all households, therefore a good vehicle to make these micronutrients available to all. According to CDC (2018), fortification of salt with iodine has been one of the most successful nutrition interventions to date as 71% of global households have access to iodized salt.

Micronutrient supplementation is the term used to describe the provision of relatively large doses of micronutrients, in the form of pills, capsules or syrups. It has the advantage of being capable of supplying an optimal amount of a specific nutrient or nutrients, in its highly absorbable form, and is the fastest way to control deficiency in

individuals or population groups that have been identified as being deficient (WHO & FAO, 2006). Standardized doses of these micronutrients are available for pregnant mothers, infants, young children and adults which when taken as recommended will prevent micronutrient deficiency throughout the lifecycle. The supplements are available in sometimes in the form of multivitamins and minerals or as individual vitamins and minerals.

The provision of Nutrition Education to pregnant women is also another intervention strategy to prevent these micronutrient deficiencies and ensure adequate consumption in the first 1000 years. Contento, 2016 observed that it is a combination of educational strategies, at the individual, institutional, community, and policy levels, accompanied by environmental supports, designed to facilitate the voluntary adoption of healthy feeding habits. The Nutrition Education programmes on adequate micronutrient consumption should be properly planned and implemented effectively by trained nutrition experts for the objectives of the Education and intended behaviour change targeted at the increased consumption of micronutrient-rich foods to be met. Exclusive breastfeeding and adequate complementary food intake together with the continuation of breastfeeding till the child is two years old have been proven to ensure optimal growth and brain development (Scherbaum 2016; UNICEF 2018; Anjorin et. et., 2019;

Stevens et.al.,2022) Breastmilk is a crucial food for children's health and development during this critical window. It provides all of the vitamins and minerals that children need to grow and thrive in the first 6 months of life, and continues to be a pivotal part of their diet up to the age of 2 or beyond (UNICEF, 2018). WHO (2020) therefore recommends early initiation of breastfeeding within one hour of birth, exclusive breastfeeding of infants for 6 months after birth and continuous breastfeeding till 23 months of age, as children and adolescents who were breastfed as babies, according to WHO (2020) are likely to perform better on intelligence tests and have higher school attendance.

The importance of adequate consumption of micronutrients especially, iron, iodine, zinc, and vitamins A, and B Complex- folic acid and cyanocobalamin are all rudiments to ensuring effective cognitive development which makes learning easier and the subsequent academic success which enhances sustainable educational pursuit and career progression at workplaces. The link between adequate micronutrient intake in the first 1000 years to the cognitive development of the brain cells and its subsequent effect on the attention span of infants, and learning in the preschool years have been established in literature over the years (Partnership for Child Development. 2019).

Conclusion

Children within the first 1000 days of life depend on the mothers' personal

nutrition and infant feeding practices, to get their daily supply of micronutrients. Micronutrients are of critical importance in the cognitive development of children as they provide structural and functional cognitive development benefits to the brain and the central nervous system during the formative periods of life. Micronutrient deficiencies often come with far-reaching consequences, particularly in brain development and functions. While some of the effects could be remedied through supplementation and/or food fortification, some of the effects result in a lifetime cognitive disability, which makes it difficult for the affected children to reach their potential educationally and attain their career goals. From the foregoing, the consumption of these micronutrients (iron, iodine, zinc, vitamin A, folate, and vitamin B₁₂) is essential to the optimum performance of their functions both in the brain and other parts of the body. The growth and development of the brain, which is the bedrock or the organ of the body that is related to learning, memory and the intellect should be preserved. The deficiency of any of the above-mentioned micronutrients in the first 1000 days of life will adversely affect the academic performance of the individual both in the formative and later years of life.

Recommendations

It is therefore recommended that:

1. Women who have plans of having children should start early (before conception takes place) to

consciously take foods that are rich in vitamins and minerals.

2. Nutrition Experts should be employed in Antenatal clinics to educate women attending these clinics on the importance of micronutrients in the growth and cognitive development both at the foetal and childhood stage.
3. Modules on meal planning by these employed Nutrition Experts for pregnant and young children under two years should be planned and taught to the women in the Maternal and Child clinics.
4. Micronutrient supplementation should be encouraged during pregnancy and lactation. Government at all levels and private sector food producers should scale up the fortification of processed foods so that most cereal products will contain sufficient quantities of micronutrients, as the staple food of Nigerians are cereal and their products.

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A Review of the Strategies for Promoting Sustainable Agricultural Production and Family Food Security in Nigeria

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Abstract

The need to provide unrestricted access to quality food and ensure nutrition security for all citizens has been at the forefront of the development agenda of all countries across the globe. Considering the cardinal role of agriculture in ensuring sustainable family food and nutrition security, goal number two of the United Nations Sustainable Development Goals (SDGs) is focused on the need to “End hunger, achieve food security and improved nutrition, and promote sustainable agriculture production”. This paper reviewed the strategies for promoting sustainable agricultural production and family food security in Nigeria. A literature search was conducted through databases such as Scopus, ISI Web of Knowledge, google scholar, directory of open access journal (DOAJ), and research gate. The search terms included keywords such as food security, strategies for promoting food security, sustainable agricultural production, family food security, sustainable production, and Nigeria among others. A total of 108 results were returned from the search, 72 papers were relevant to the study, while the authors were unable to access 11 of the papers. The authors assessed the full texts of all the available articles through narrative synthesis following laid down eligibility criteria. The results revealed that several studies have been conducted on the strategies for promoting sustainable agricultural production and family food security in Nigeria. Several recommendations were made among which is the need to repurpose agricultural development policies, empower small-scale farmers, adopt sustainable agricultural practices, promote all-season agricultural production, and provide modern agricultural food processing and storage facilities.

Keywords: Food security; Agricultural production; Family, Sustainable strategies; Agricultural promotion

Introduction

Nigeria is one of the largest countries in sub-Saharan Africa in terms of its landmass, population size and

economy. According to the United Nations Department of Economic and Social Affairs, Population Division (2022), Nigeria’s population is

estimated to range from 200.96 million to 206 million. One cardinal challenge faced by the Nigerian government as well as other governments globally is the need to provide unrestricted access to quality food and ensure nutrition security for all citizens and achieve this on a sustainable basis. The threat of hunger and starvation has been on the increase globally, threatening food security at various levels. The FAO (2022) reported that the number of people going hungry and suffering from moderate or severe food insecurity was already on the increase from 2014 until 2019, and took a sharp upturn in 2020 due to the COVID-19 pandemic. The FAO (2022) observed that the Covid-19 pandemic may have pushed up to 210 million more people into the group of those who suffer from hunger. This trend persisted through 2021 and 2022 as the food supply system and food chain were disrupted; coupled with a general slowdown in the economy globally. The agriculture sector which is seen as key to attaining food security has been adversely affected in many parts of the world leaving a gap in the food system.

In Nigeria, the story is not any different as the State of Food Security and Nutrition in the World (SOFI) (2021) reported that about 29.4 million people were undernourished in the 2018-2020 period, with a similar pattern concerning food security where the percentage of the population living under moderate or severe food insecurity has risen steadily from 36.5% in 2014-2016 to 57.7% in 2018-2020. This implies that

slightly more than half of Nigerians, or over 100 million people, report at least a moderate form of food insecurity. Nigeria has been suffering from food insecurity and poverty, with a steady increase in the prices of food over the years and deterioration in the living standard, with a consequent decline in the income of most people which can no longer sustain them in families.

Bearing in mind the cardinal place of agriculture in ensuring sustainable family food and nutrition security, goal number two of the United Nations Sustainable Development Goals (SDGs) is focused on the need to “End hunger, achieve food security and improved nutrition, and promote sustainable agriculture production”. According to FAO (2018), a sustainable agriculture sector can help achieve multiple Sustainable Development Goals (SDGs), hence according to Mollier et al., (2017); and the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP) (2021), properly nourished children can learn, people can lead healthy and productive lives and societies can prosper. By nurturing our land and adopting sustainable agriculture, present and future generations will be able to feed a growing population.

The FAO, IFAD, UNICEF, WFP and WHO (2022) posited that meeting the targets of SDG 2 by 2030 requires that the agricultural food systems must be transformed in ways that ensure they deliver lower-cost and

safe nutritious foods that make healthy diets more affordable for all, sustainably and inclusively. According to FAO, IFAD, UNICEF, WFP, and WHO (2022), the agricultural food system encompasses both agricultural and food systems and focuses on both food and non-food agricultural products, and encompasses the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption, and disposal of food products. They comprise all food products that originate from crop and livestock production, forestry, fisheries, and aquaculture, as well as the broader economic, societal, and natural environments in which these diverse production systems are embedded. The transformation of the agricultural food systems for sustainability and inclusivity holds the key to sustainable food security both at national, regional, and global levels.

Despite several studies and efforts by governments at various levels to ensure food security for all, food insecurity continues to be a threat. According to FAO (2022), the world tends to be moving in a different direction with eight years remaining to end hunger, food insecurity, and all forms of malnutrition (SDG Targets 2.1 and 2.2), and promote sustainable agriculture production. This paper posits that agriculture holds the key to sustainable food security at both the family, national, and global levels, and a key driver for the attainment of the other SDGs, hence the need to

review the strategies for promoting sustainable agricultural production for family food security. This is expected to generate the required information to guide policy decisions in the agricultural food system and value chain. The objectives of this article are to:

1. Review the concept and need for food security and sustainable agricultural production.
2. Review the challenges to food security and sustainable agriculture in Nigeria
3. identify the efforts of the Nigerian government to achieve food security
4. Review the strategies for promoting sustainable agricultural production in Nigeria

Methodology

This review work adopted a comprehensive literature search/library-based study and dwelt wholly on secondary information sources using descriptive techniques. A comprehensive literature search was conducted using search engines/databases such as Scopus, ISI Web of Knowledge, google scholar, directory of open access journal (DOAJ), and research gate. The search terms included keywords such as food security, strategies for promoting food security, sustainable agricultural production, family food security, sustainable production, and Nigeria among others. A total of 108 results were returned from the search, 72 papers were relevant to the study, while the authors were unable to access 11 of the papers. The authors

assessed the full texts of all the available articles through narrative synthesis following laid down eligibility criteria. The authors reviewed the literature and the result of the review is presented in this article under various sub-headings.

Theoretical Framework

The theoretical framework that births this review is the Malthusian theory on population growth. Thomas Robert Malthus (1766-1834) in the 18th century, warned that the population of the world would exceed the earth's capacity to grow food. In his theory on population growth, Malthus posits that population grows in geometrical progression while food production grows in arithmetical progression. This theory has maintained its usefulness over the years in discussions on hunger, the world's population-carrying capacity, and the need for increased agricultural technology to sustain food security. Malthus stressed that population increases most especially among the poor because they breed too rapidly and deprive the rest of the population of food. By implication, famine is seen as a natural defence against overpopulation.

This theory fits into the food situation in Nigeria. According to Ammani et al., (2015), Nigeria's population has increased steadily from 55 million according to the 1963 census figures, to 140 million in the 2006 national census to an estimated more than 170 million in 2015. The FAO (2021) notes that the country's population will reach 400 million by

2050. This rapid population growth has increased substantially the demand for food in the country. Current food production in the country is however far below the increase in the population thus the relevance of the Malthus theory to the Nigerian situation.

Concept and Need for Family Food Security

Food security is a concept that has been variously defined by scholars and authors. According to Economic Intelligence Unit [EIU] (2018), food security is a complex, multifaceted concept usually influenced by culture, environment, and geographical location. According to the FAO (2022), food security connotes a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. FAO (2022) describe food security from the above perspective to encompass four dimensions: food availability, economic and physical access to food, food utilization, and stability over time. Perez-Escamilla et al. (2017) citing the Food and Agriculture Organization of the United Nations (FAO) gave a clear definition of "food security at five different levels - individual, household, national, regional, and global levels.

The High-Level Panel of Experts (HLPE) (2020) of the Committee on World Food Security described in detail the four key dimensions of food security and added two additional

dimensions – agency and sustainability. The availability dimension addresses whether or not food is actually or potentially physically present, including aspects of production, food reserves, markets and transportation, and wild foods; while access – describes whether or not households and individuals have sufficient physical and economic access to that food. Food utilization considers whether or not households are maximizing the consumption of adequate nutrition and energy; while stability is the condition in which the whole system is stable, thus ensuring that households are food secure at all times. According to the HLPE (2020), stability raises issues related to short-term instability which can lead to acute food insecurity, or medium to long-term instability which can lead to chronic food insecurity. Agency refers to the capacity of individuals or groups to make their own decisions about what foods they eat; what foods they produce; how that food is produced, processed, and distributed within food systems; and their ability to engage in processes that shape food system policies and governance. Sustainability refers to the long-term ability of food systems to provide food security and nutrition in a way that does not compromise the economic, social, and environmental bases that generate food security and nutrition for future generations (HLPE. 2020). The issue of sustainability calls to question the sustainability of the entire agricultural food system.

The absence of one or more of the dimensions or components of food

security may technically be referred to as food insecurity. According to FAO (2008) and Jones et al. (2013), food insecurity is conventionally classified into two categories; chronic and transitory, while seasonal food insecurity falls in between the two. Chronic food insecurity is a long-term or persistent situation where people can no longer meet their minimum food requirement over a sustained period while transitory food insecurity is commonly short-term or temporary and it relates to short periods of extreme scarcity of food availability and access (Barrett and Sahn, 2001; Hart, 2009; Afolabi et al. 2018).

Food security at all levels is essential because food is a necessity for human beings. According to FAO (2018), properly nourished, children can learn, people can lead healthy and productive lives and societies can prosper. Food security can thus be said to form the basis for human prosperity. When a society has ample food, the citizens tend to lead a happier and more fulfilling life and an enhanced standard of devoid of health and societal ills. According to Amaechi (2018), food security presents a favourable image of a people and country to the international community and contributes to creating a veritable atmosphere for healthy governance.

Concept and Need for Sustainable Agriculture Production in Nigeria

The principal goals of agricultural production globally are to produce adequate foods, fibres, and industrial raw materials to satisfy the needs of

the increasingly growing population. Several strategies, methods, and techniques are devised to achieve the goals. These strategies, methods, and techniques vary from one community or nation to another but generally may encompass increasing the area under cultivation, adopting higher yielding varieties of crops, increasing the use of chemical fertilizers and other forms of manures, developing and use of irrigation technologies, mechanization of agricultural processes, and the practice of multiple cropping among others.

Agricultural production generally depends on the environment for the basic resources required and in turn produces varying effects on the resources in the process of their utilization. According to Xu et al. (2021), agriculture plays key roles in the health of the environment such as driving climate change, by accounting for about 37 per cent of anthropogenic greenhouse gas emissions. Benton et al. (2021) added that agriculture production contributes to deforestation and declining biodiversity; while Kanter et al. (2020) observed agriculture's contribution to air and water pollution. The contributions of agriculture production to soil degradation; driving the emergence and/or spread of disease and the role in antimicrobial resistance have been respectively identified by Lal (2019) and Amuasi, Lucas, Horton, and Winkler (2020).

To minimize the deleterious consequences of agriculture on the environment and ensure sustainable food production, target 2.4 of the

SDGs is focused on ensuring sustainable food production systems and implementing resilient agricultural practices that increase productivity and production, help maintain ecosystems, strengthen capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters and that progressively improve land and soil quality (FAO, 2018). Sustainable agriculture, therefore, helps to promote the quality and health of the critical resources required for agrifood production and is central to the 2030 Agenda for Sustainable Development. According to Zero Hunger Challenge, (2016), sustainable agriculture is a key aspect of the food system that contributes to enhancing farm incomes and household food security, especially in developing countries.

Sustainable agriculture is principally focused on actions intended to protect the environment, natural capital, and the ecosystem from deterioration, and at the same time ensure maximum and consistent crop yields. According to Iniodu (1997), sustainable agriculture aims at resource improvement and at preventing long-term reduction in the productivity of resources and promoting intergenerational equity. Sustainable agriculture promotes natural processes, minimizes waste, conserves the environment, and ensures profitability. When an agriculture system is sustainable, the products will be nutritious, and free from contamination by substances that may be unsafe for human consumption. Sustainable agriculture

promotes an eco-friendly environment which is achieved largely by avoiding the use of dangerous inputs that have damaging effects on the agriculture production resources and promoting their long-term usefulness and productivity.

The Challenges to Achieving Food Security and Sustainable Agriculture in Nigeria

1. Decreasing farm sizes - the decrease in the average farm sizes is a result of the rapid increase in population growth (Barbier & Hochard, 2018). As the population increases as foretold by Thomas Malthus in his theory of population growth without a corresponding increase in the area available for agricultural production, the available land will become fragmented.
2. The impacts of climate change - have caused the degradation of the environment, poor yields, lower farm incomes, food insecurity, and poverty among others (Dillon & Barrett, 2017).
3. Drought - according to the Ministry of Agriculture and Water Resources, a key factor that accounts for the food crisis in Nigeria is the total reliance on rain-fed agriculture. The contribution of irrigation agriculture is very minimal as the country has not taken full advantage of its irrigation potential estimated between 2.0 - 2.5 million hectares".

4. Flooding - excessive rain has also contributed significantly to the current hike in food prices.
5. Low and inappropriate use of fertilizers, and other farm inputs
6. The neglect of the agricultural sector. The agriculture sector in Nigeria has been largely neglected and has not received up to 10 per cent allocation in the federal budget in any given year as stipulated in the minimum requirement according to the Maputo Declaration of sufficient food production. The budgetary allocation has been significantly lower than this at 1.7% in 2017, 2.0% in 2018, 1.56% in 2019, 1.34% in 2020, and 1.37% in 2021 (Izuaka, 2021).

Ekpu (2009) presented the following as obstacles to sustainable agriculture and food security:

- Policy instability, that is, the frequent changes of policies on agriculture as one government replaces another. On each occasion, Nigeria has always had to start afresh.
- Agriculture is still regarded as a vocation for the illiterates in rural areas who have nothing better to do. The big farmers - politicians, retired generals, and businessmen - engage largely in crops or animal cultivation that are not common staples. They have pineapple plantations, ostrich, and other exotic farms that add nothing to our quest for food security. The lack of mechanized farming is certainly something to worry about.

- Improper administration of the agriculture credit scheme
- Corruption which has been a serious problem in the country has not left agriculture untouched. The river basins, dams, silos, and fertilizer contracts have, over the years, been dripping with corruption.
- Many women are small-scale farmers; in fact, they form the bulk of the farming constituency but hardly are they consulted on policy and or gender issues that affect agriculture, land ownership, and or usage.
- Farmers are not well remunerated for their products. Nigeria produces the largest quantities of cassava, yams, and cocoyam in the world, but the impact on their income is minimal and this tends to discourage them.
- Fertilizer is an important ingredient for improved yield but Nigeria plays politics with it. The people who get fertilizer allocations hardly have farms; they only have party cards.

Efforts of the Nigerian Government to Promote Food Security

Several agricultural development projects and empowerment programs have been initiated all aimed at providing a conducive environment for players in the agricultural food production value chain to increase their productivity. Some of the efforts according to IITA (2017); Olomola (2017); Olomola and Nwafor (2018) and Otekunrin et al. (2019) are summarized below:

- **National Accelerated Food Production Programme (NAFPP)** – the NAFPP was introduced by both the Federal and state governments to facilitate the production of grains such as maize, rice, guinea corn, millet, wheat, cassava, and cowpeas among others (Daneji, 2011). The programme was based on the notion that when these are produced bountifully, it will help to address the problem of hunger and related food crisis.
- **River Basin Development Authority (RBDAs)**. The RBDAs were designed to provide irrigation facilities through the construction of dams for all-year-round agricultural production, provision of potable water to people in rural areas for increased production, assisting to bring more land under cultivation by increasing the farm size of small-scale farmers through the provision of land clearing services using government tractor hiring services at minimum charges, construction of feeder roads to the rural areas for good transportation, improving the rural areas infrastructures, generally to help stem the rural-urban migration.
- **Green Revolution Programme (GR)** – under the GR, farmers were provided with several incentives to boost their production level. The programme covered both livestock and crop components and the reorganization of the research institutes to make them more responsive to the need of the sector.
- **Operation Feed the Nation (OFN)** The OFN was designed to address

the issues associated with the rising food crisis, rural-urban migration, and increasing food imports. The OFN mobilize and motivated the general public to participate actively in agricultural production through the subsidization of production inputs, increased bank credit to farmers, the establishment of commodity boards, and the fixing of attractive prices for agricultural produce.

- **Agricultural Development Projects (ADPS)** The Agricultural Development Projects came in 1975, after a bilateral agreement between the Federal Government of Nigeria and the World Bank. The two Basic aims and Objectives that ADPS were meant to achieve include, increased food production and raising of income of the small-scale farmers, with the ultimate goal of improving their standards and welfare.
- **Directorate for Food and Rural Infrastructure (DFFRI)** - The programme was designed to improve the quality of life and standard/level of living of rural dwellers. Its focus was on the improvement in nutrition, housing, health, employment, road, water, industrialization, etc. through the use of resources that exist in the rural areas and mass participation of the rural people in productive ventures.
- **National Agricultural Land Development Authority (NALDA)** - NALDA was aimed at providing strategic support for land development, assisting and promoting better uses of Nigeria's

rural land and its resources, boosting profitable employment opportunities for rural dwellers, raising the level/standard of living of rural dwellers, target and assist in achieving food security through the promotion of self-reliance and sufficiency.

- **National Fadama Development Project (FDP)** The first national Fadama Development Project (NFDP-1) was designed in the early 1990s to promote simple low-cost improved irrigation technology under World Bank financing. The main objective of NFDP-1 was to sustainably increase the incomes of the Fadama users through the expansion of farm and non-farm activities with high value-added output. The scheme was designed to improve the flooded plains of Savannah (Fadama). The relative success of Fadama - 1 led to the establishment of Fadama II and Fadama III.
- **National Special Programme for Food Security (NSPFS)** - The programme aimed to attain food security and alleviate rural poverty in Nigeria. It is aimed at helping farmers to increase output and income, strengthen extension service delivery, promote simple farm technologies, and utilize land, water, and other resources for food-productive ventures (Iwuchukwu and Igbokwe, 2012).
- **Nigerian Agricultural and Co-operative Bank** - the NACB was developed to provide credit for the development of agriculture and other agro-allied industries, including the marketing of

agricultural products. Unlike other financial institutions, NACB assists all its clients “to adopt modern agricultural technologies and good management practices through advice from specialists among its staff” (NACB, 1986).

- **Root and Tuber Expansion Programme (RTEP)** - was designed to address the problem of food production and rural poverty. At the local farmer’s level, the programme hopes to achieve economic growth, improve access of the poor to social services and carry out intervention measures to protect poor and vulnerable crops. At the national level, the programme is designed to achieve food security and stimulate demand for cheaper staple food such as cassava, garri, yam, potato, etc. as against more expensive carbohydrates such as rice
- **National Economic Empowerment and Development Strategy (NEEDS)**. The key elements of the development strategy included poverty eradication, employment generation, wealth creation, and value reorientation. NEEDS provided help to agriculture, industry, small and medium-scale enterprises, and oil and gas.
- **National Policy on Food and Nutrition (NPFN)** - The National Food and Nutrition Policy is designed to address the problems of food and nutrition insecurity in Nigeria, from the individual, household, community, and national levels. It provides a framework for the identification, design, and implementation of

intervention activities across different relevant sectors (IITA, 2017; Olomola, 2017; Otekunrin et al. 2019).

- **Agricultural Transformation Agenda (ATA)** The ATA (2011-2015) was designed and implemented by the Federal Ministry of Agriculture with a focus on food security and agricultural productivity. According to Olomola and Nwafor (2018) and Otekunrin et al. (2019), the main components of ATA include:
 - a. The commissioning of the Growth Enhancement Support Scheme (GESS) to enhance the availability of modern-day agricultural inputs to farmers at subsidized rates.
 - b. The development of the Staple Crop Processing Zone (SCPZ) to facilitate clustered food production in regions considering the comparative advantage of each agroecological zone or region.
 - c. The introduction of the Agricultural Commodity Value Chain Development (ACVCD) to promote the development of crop and livestock sub-sectors in different agroecological zones.
 - d. The introduction of the Agricultural Marketing and Trade Development Corporations (AMTDCs) to advance smallholder farmers’ access to markets.
 - e. The promotion of the Agricultural Extension Transformation Agenda (AETA) aimed at enhancing the dissemination, diffusion, and adoption of innovations by smallholder farmers.
 - f. The establishment of the Nigerian Incentive-based Risk-Sharing

System for Agricultural Lending (NIRSAL) to address the challenges in the agricultural commodity and financing value chains.

Strategies for Promoting Sustainable Agriculture Production and Food Security

1. Application of sustainable agricultural practices (SAPs) in food crop production - One way of maintaining the quality of the environment and improving crop yields, farm incomes, and food security at the same time is to promote the adoption of sustainable agricultural practices. According to Issahaku and Abdulai, (2019), the adoption of SAPs correlates with food security. Morugán-Coronado et al. (2020) showed that various combinations of sustainable agricultural practices (SAPs) including minimum tillage, use of organic fertilizers, and alley cropping resulted in positive crop yield response, as well as soil organic carbon and nitrogen accumulation.
2. Repurposing agricultural and food policy support - according to a joint report published by the Food and Agriculture Organization of the United Nations (FAO), United Nations Development Programme (UNDP), and United Nations Environment Programme (UNEP) (2021), repurposing entails the reduction of support measures that are inefficient, unsustainable and/or inequitable, to replace them with support measures that are the opposite. In other words, support is

not eliminated but reconfigured. In this way, repurposing will always imply reforming. According to FAO, IFAD, UNICEF, WFP, and WHO. (2022), rethinking the allocation of public spending to repurpose food and agricultural policies is urgently needed.

3. Development of post-harvest technology - according to Amaechi (2018), this assumes particular importance, especially in the case of perishable commodities like fruits, vegetables, milk, egg, fish, and other animal products and processed food. There must not be a mismatch between production and post-harvest technology if the goals of promoting sustainable agriculture, eliminating hunger, and ensuring food security at all levels are to be achieved. Promoting the post-harvest sector also has multiplier effects on rural income and poverty reduction.
4. Systematic development of the farming system - It is important to consider the composition of the farming system such as soil components, water availability, agro-climatic features, home needs, and above all marketing facilities and opportunities in the choice of crops, farm animals and unique culture systems to adopt.
5. Climate resilient practices should be integrated into agricultural and food system policies and programs. Efforts should be made to promote climate-smart agriculture through targeted extension services, improved crop choices, investment in machinery, and increased access to improved animal feed and breeds

- to protect soils and biodiversity, conserve water, and limit land-cover change. Donor support should be targeted to greenhouse gas emissions-reduction efforts, thus contributing to the more ambitious mitigation target reflected in Nigeria's updated nationally determined contribution, which is conditional on such support (FRN, 2021; 2016)
6. Introduction and adoption of modern sustainable farming practices- The agricultural system need to accept and adopt modern sustainable farming such as planting better seeds and seedling, the use of safe chemical for pest and insect control, as well as disease control among others. Oni (2013) recommended the promotion of sustainable cultural practices with various technologies recommended by experts; the adoption of new technologies use for post-harvest work to improve productivity and minimize waste as well as control environmental pollution.
 7. Monitoring of weather and market events - Real-time actionable intelligence, such as weather and climatic conditions, should be provided to farmers through a specialized channel of the Nigerian Meteorological Agency. According to World Bank cited in FAO, IFAD, UNICEF, WFP and WHO (2022), farmers should in addition to climate and weather events, be made aware of labour data and market conditions so that they can protect themselves and their products from price volatility which impacts their earning abilities.
 8. Upward review of budget allocation to the agriculture sector - The budget for the agriculture sector should be revisited and increased to reflect the current situation of the sector. Nigeria is a signatory to the Maputo Declaration of 2003 where African countries committed to spending at least 10% of their annual budget on agriculture. However, the budgetary allocation has been significantly lower than this at 1.7% in 2017, 2.0% in 2018, 1.56% in 2019, 1.34% in 2020, and 1.37% in 2021 (Izuaka, 2021).
 9. Reactivate dead agro agencies - The government should immediately revisit dead or dilapidated agro-agencies. Most of these agencies were the powerhouse driving progress within the agro-sector of Nigeria but have unfortunately become neglected and abandoned (Voh Jr, 2017).
 10. Research institutes should be reequipped and repositioned to carry out their mandates effectively. Further, efforts should be made and strategies evolved for effective communication of research findings and innovations to stakeholders in the agricultural and food system. These institutes, such as the Institute for Agricultural Research, offer extension services to farmers and other stakeholders in the agricultural value chain and drive the utilization of green and sustainable approaches in agricultural production, processing, and research (Voh Jr, 2017).

Conclusion and Policy Recommendations

Agriculture holds the key to sustainable food security at both the family, national, and global levels, and is a key driver for the attainment of the other SDGs. This is so because when people are properly nourished, children can learn, households can lead healthy and productive lives and societies can prosper. By nurturing our land and adopting sustainable agriculture, present and future generations will be able to feed a growing population. This will introduce intergenerational equity in the agriculture food system and promote the long-term productivity of agricultural production resources. Agricultural development policies and programmes of the government are efforts aimed at reducing the challenges of food insecurity and hunger and combating the menace posed by the threats of climate change and related environmental crises. However, the threats of food insecurity continue to thrive as the percentage of the population who are food insecure continues to rise annually. The following policy recommendations can guide the development of policies and actions of stakeholders in the agriculture sector for more sustainable agricultural production and food security.

- ❖ All stakeholders in the design and implementation of agriculture development policies should be involved through all stages and phases of the programme lifespan to promote acceptability and

greater success in the implementation

- ❖ The agricultural extension agents and other organizations tasked with the education of farmers should educate farmers on the adoption of sustainable agriculture practices to promote sustainability of their production practices and reduce the cost
- ❖ There should be regular monitoring and evaluation of agricultural policies and programmes to observe lapses, modification of the programmes, and reduce the rate of programme failures. Monitoring and evaluation should be integrated into all stages of the programme development and implementation.
- ❖ There should be greater stability and consistency in the formulation and implementation of agricultural policies and programmes. The lifespan of agricultural policies and programmes should not be tied to the tenure of the administration that designed such policies. Measures should be integrated into the design of such policies to promote sustainability.
- ❖ There should be greater involvement and participation of the private sector in agricultural development efforts. Government should therefore provide an enabling environment for private sectors to get directly involved in areas like processing, preservation, exportation, tourism, and recreational and environmental services.
- ❖ Environmental impact assessment should be carried out

for all agricultural development programmes and policies. The formulation of agricultural development policies and programmes should take into consideration the peculiarities of farmers and the environment so that all concerned can make appropriate and necessary contributions to maintaining environmental quality and promoting sustainable agriculture.

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Evaluation of Peer Relationship and Social Adaptation of School-Aged Children in Enugu North Local Government

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Abstract

This study evaluated the peer relationship and social adaptation of school-aged children in Enugu North Local Government Area (LGA), Enugu State. A cross-sectional survey design was employed in a population of 60,780 (29,968 males and 30,812 females) schoolchildren in the LGA. Multi-stage sampling method was employed in the selection of 602 school-aged children from 58 schools who formed the sample for the study. Three research questions guided the study. The reliability of the instrument was ascertained using Cronbach's alpha reliability index and scores of 0.50 and 0.70 for the peer relationship questionnaire for children, and the social adaptation scale respectively were obtained. Statistical Product for Service Solution (IBM-SPSS) software version 23, was used. Descriptive statistics (frequencies, percentages, mean and standard deviation) and inferential statistics (Spearman Rank Order correlation) were conducted, and presented in the form of tables. Most (62.6%) of the respondents showed moderate social adaptation mostly when they are with their families (4.53±2.31). The majority (76.6%) had low peer relationships. A significant positive relationship was found between peer relationships and social adaptation. Governmental and non-governmental organizations should therefore organize programs that will facilitate peer relationships and social adaptation among school-aged children and also educate teachers and parents to be of great help to the children.

Keywords: Peer relationship, Social-adaptation, School-aged, Enugu North

Introduction

According to United Nations (2019) report, 661,761 thousand school-aged children make up the world's population. School-aged according to the American Academy of Pediatrics (2020) comprises individuals in the 6-12 years age group. School-aged children are in the age period commonly referred to as middle childhood. Children start formal schooling at this age. Across the world, by the time a child is entering middle childhood, they are being educated in some form or fashion. Children's cognitive and social skills are evaluated as they enter and progress through school (World Bank, 2021). This implies that school plays a very important role in a child's life. It helps in the overall growth and personality development of a child from positive interaction to widening horizons to character building, communal harmony and social socialization, learning of new things, and social development (Jackie, 2019). In 2018, Nigeria had 22.4 million school-aged children enrolled in public elementary schools and 5.5 million in private schools (Simona, 2021). A report from the Enugu State Ministry of Education (2014) showed that a total of 187,495 enrolled in public schools (56%) while 148,191 enrolled in private schools (44%). In Enugu North, there are 13,341 school-aged children in public schools and 14,484.

Middle childhood which encompasses school-aged children is a stage where children move into expanding roles and environments. At this stage, more time is being spent on schoolwork and other activities.

School-aged children have more and more interactions with their peers, and their peer relationships have become increasingly closer. Peer relationships can be defined as how two or more people of the same rank, value, quality, or ability; talk to, feel, behave, toward and deal with each other. It is a connection between two or more people of the same age, or the same social position or the same abilities or of equal standing. Peer theory and empirical research have shown that peers are an important source of children's social development and an important influencing factor for children's self-concept and healthy personality formation (Wu et al., 2011). Pepler and Bierman (2018) claim that peer interactions offer a singular framework for children to develop a variety of essential social-emotional abilities, including empathy, cooperation, and problem-solving techniques. The impact of peer relationships at school may facilitate the social adaptation of school-aged children.

Sam (2013) describes social adaptation as the process of adjusting to the rules, expectations, and morality of the society in which we all coexist. Social adaptation is a process in which individuals actively regulate their behaviours to achieve a state of balance and coordination with their external environment (Haowen et al., 2021). The level of social adaptation reflects the social and psychological maturity of an individual. School-aged children are at an important age of psychological maturity in life, and the social adaptation status is not only

related to their psychological health development but also affects interpersonal harmony and social stability. The social skills, social awareness, and self-confidence of a child all have a role in how well they can adjust socially. Factors such as the child's self-confidence or social anxiety can affect his or her social adaptation (Encyclopedia of Children's Health, 2021).

According to Boivin (2014), early peer relationship difficulties are correlated with a variety of adjustment problems such as school dropout, delinquency and emotional problems, such as loneliness, depression and anxiety. Yet the evidence for long-term consequences of peer difficulties experienced in the school-age years is limited, as other potential causes (e.g. personal or environmental factors) have not been ruled out. Peer rejection, however, seems to increase the likelihood of maladjustment in young children who already exhibit behavioural and emotional issues. These issues, though usually not fatal, have an impact on children's development, learning, interpersonal connections, and future health and well-being as adolescents and adults. In Nigeria, little is known about the prevalence of peer relationships among school-aged children and the social adaptation of school-aged children, possibly due to its implicit and subconscious nature. It is therefore imperative to conduct this study.

Objectives of the study

The objectives of the study were to:

1. determine the peer relationship status of the school-aged children;
2. ascertain the social adaptation status of the school-aged children and
3. evaluate peer relationships and social adaptation of school-aged children.

Methodology

Study design: A cross-sectional survey design was employed in this study, which was selected because it allows the comparison of different variables at the same time from the cross-section of the population.

Study population: The study population comprised school-aged children in Enugu North Local Government Area of Enugu State. According to the Ministry of Education (2019), the population of the study consisted of 60,780 primary school pupils (29,968 males and 30,812 females) in the 290 registered primary schools in Enugu-North Local Government Area in Enugu State, Nigeria.

Sampling Technique/Sample Size

Determination: Multi-stage sampling method was used to select the eligible school-aged children for the study. The first stage involved cluster sampling of the schools into private (240 schools) and public clusters (36 schools). The second stage involved the use of simple random sampling without replacement to select 5% of schools in each cluster. This gave a total of 15 schools- 3 schools from the public cluster, and 12 schools from the private cluster. The third stage involved the calculation of sample size using the WHO (2013) formula.

This gave a total sample size of 602 (252 pupils from the public cluster and 350 from the private cluster). The fourth stage involved proportionate sampling of the school-aged children in each of the selected schools. The final stage involved a random selection of primary five and six children present on the day of the visit whose parents' and teachers' consent has been obtained. These two classes were selected because the children were considered more capable of giving a self-report.

Instrument for Data Collection: A structured questionnaire and two standardized questionnaires were used to elicit information from the respondents. The questionnaire contained items on the socio-economic/demographic characteristics of the respondents. The standardized instruments were the Peer Relation Questionnaire for children (PRQ; Rigby & Slee, 1993), and Social Adaptation Scale (SAS; Robson, 2013). The PRQ is a 20-item questionnaire which contains three subscales: (a) bullying (6 items), (b) victimization (6 items), and (c) pro-social behaviour (4 items); and four filler items. The items were rated on a 4-point Likert scale; never (1), once in a while (2), often (3), and very often (4). Children were asked to indicate how often the statements apply to them for the various categories. A sample item for bullying others is 'I like to make others scared of me', an item for being victimized by others includes 'I get picked on by other kids', and an item for prosocial behaviour was 'I share things with others'. The SAS consists of 44 items and it was

used to assess the children's social adaptation level. The scoring was performed on a five-point scale, ranging from 1 = strongly disagree, 2 = disagree, 3 = Neutral, 4 = agree, and 5 = strongly agree. A high score represents high social adaptation. The arithmetic mean above 3.0 was regarded as high social adaptation, while below 3.0 was regarded as low adaptation.

Validity and reliability of the instrument: The reliability of the instruments for the study was ascertained using Cronbach's alpha reliability test. Coefficient scores were 0.50 for the Peer Relation Questionnaire (PRQ) indicating moderate internal consistency, and 0.70 for the Social Adaptation Scale (SAS) indicating high internal consistency of the items.

Method of Data Collection: Data were collected using a questionnaire. A total of 602 questionnaires were shared by trained research assistants to the selected children by hand after written consent was obtained from their parents. The researcher explained the purpose of the study to the respondents and the modalities of answering the questions. Each of the questions on the questionnaire was read out aloud and explained as the respondents were encouraged to tick the applicable answer. The questionnaires were filled on the spot. Each questionnaire took about 15 minutes to be filled out. Two research assistants assisted in the data collection. The research took 8 weeks to be completed. A total of 594 questionnaires were retrieved with a return rate of 98.7%.

Data and Statistical Analysis: the collected data were sorted and cleaned from errors and missing information. The data collected was coded and analyzed using the computer software known as Statistical Product and Service Solutions (SPSS) version 23.0.

For peer relationships, the minimum and maximum obtainable scores are 20 and 80 respectively. Raw scores ranging from 20 to 50 were categorized as low while scores from 51 to 80 were categorized as high. Under the bullying sub-category of peer relationships, the minimum and maximum obtainable scores are 6 and 24 respectively. Scores ranging from 6 to 14 were categorized as low while scores ranging from 15 to 24 were categorized as high. Under the victim sub-category of peer relationship, the minimum and maximum obtainable scores are 6 and 24 respectively. Scores ranging from 6 to 14 were categorized as low while scores ranging from 15 to 24 were categorized as high. Under the pro-social sub-category of peer relationships, the minimum and maximum obtainable scores are 4 and 16 respectively. Scores ranging from 4 to 9 were categorized as low while scores ranging from 10 to 16 were categorized as high.

For social adaptation, the minimum and maximum obtainable scores are 26 and 130 respectively. Raw scores ranging from 26 to 60 were categorized as low, scores ranging from 61 to 94 were categorized as moderate while scores ranging from 95 to 130 were categorized as high. Results were

presented as frequencies and percentages, means and standard deviations. Spearman rank order correlation was used to ascertain the relationship between the variables. Significance was accepted at 95% precision ($p < 0.05$). The decision rule for peer relationship, and social adaptation was set at mean scores greater or equal to 2.5, and 3.0 respectively as agreed.

Results

The socio-demographic characteristics of the respondents revealed that 41.4% of the respondents were from public schools while 58.6% were from private schools. The females among them were 57.9% while the males were 42.1%. Most (55.9%) of them were within 9-11 years and the least percentage (3.4%) was those in the age range of 6 to 8 years. Most (85.2%) of the children had both of their parents married and living together while a few (4.7%) of them had separated parents. A higher percentage (55.6%) of children had their classmates as their best friends while a lower percentage (5.4%) had their best friend as their teacher. About half (51.7%) of the school-aged children were in primary six while 48.3% of the children were in primary 5.

Peer Relationship Status of the Children

Table 1 indicates the peer relationship status of school-aged children. Data showed that the majority (76.6%) of the school-aged children had low peer relationships while only 23.4%

<p>had high peer relationship status. In terms of the categorization of the peer relationship status, a greater percentage (95.8%) of the children had low scores on bullying while only 4.2% had high scores on bullying.</p>	<p>About 81.6% are less prone to bully while 18.4% had high victim status. Few (17.2%) of the children had low pro-social status while the majority (82.8%) had high pro-social status.</p>
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Table 1: Frequency and percentage scores on the Peer Relationship Status of the school-aged children

Variables	<i>f</i>	%
Peer Relationship Status		
Low peer relationship	455	76.6
High peer relationship	139	23.4
Total	594	100
Peer relationship categorization		
Bullying		
Low Bullying	569	95.8
High Bullying	25	4.2
Total	594	100
Victimization		
Low Victimization	485	81.6
High Victimization	109	18.4
Total	594	100
Pro-Social		
Low Pro Social	102	17.2
High Pro Social	492	82.8
Total	594	100

Social Adaptation Level of the Children

Table 2 indicates the level of social adaptation of the children. It can be seen that the majority (62.6%) of the school-aged children had moderate social adaptation levels, 36.7% had high social adaptation levels, and only 0.7% had low social adaptation.

Table 2: Frequency and percentage score on the social adaptation level of the school-aged children

Variables	<i>f</i>	%
Low social adaptation level	4	0.7
Moderate social adaptation level	372	62.6
High social adaptation level	218	36.7
Total	594	100

<p>Peer Relationship and Social Adaptation of the Children</p>	<p>Table 3 shows the interaction between peer relationships and social adaptation of school-aged children.</p>
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From the table, peer relationship was positively and significantly related to social adaptation ($r=0.201^{**}$, $p < 0.05$) although the relationship was weak.

This implies that as their peer relationship status is increasing, their social adaptation level is also increasing.

Table 3: Peer relationship and social adaption level of the school-aged children

			Peer Relationship	Social Adaptation
Peer Status-	Relationship	Correlation Coefficient	1	0.190**
		Sig. (2-tailed)		0.001
Social Adaptation-		Correlation Coefficient	0.190**	1
		Sig. (2-tailed)	0.001	

** Correlation is significant at 0.01 level (2-tailed) * correlation is significant at the 0.05 level (2-tailed).

Discussion

In the study, the status of peer relationships was found to be low (76.6%) among school-aged children. This contradicts the findings of Lu (2020) who revealed that the majority (85.15%) of the students can maintain a relatively stable peer relationship development. This variation could be a result of their relationships at home with parents and siblings, the parent relationship and the family's levels of social support. The children displayed low bullying and low victimization. This could be linked to their family condition as the majority reported having both parents alive. Asides from the majority of the children that had their classmates as their best friends, most of them mentioned their parents as their best friends. This supports the opinions of Jeynes (2008) and Leraya et al (2013) that parents act as both protective factors and resources for the prevention of bullying. The findings of the study also reveal the children's competency in regulating their emotions. High pro-social behaviour

was however observed among the children. This affirms the work of Van den Bos et al. (2011) who showed that prosocial behaviour has a positive relationship with age. This is so as the majority of the children were within nine to eleven years. The most outstanding characteristic of school-aged children is being of help to others. Sharing and helping are the two basic prosocial behaviours that start to emerge in early childhood and eventually become more pronounced in adulthood (Dunfield et al., 2011). According to Jones et al. (2015), pro-social behaviours are a hallmark of social competence in children of all ages and correlate with social adjustment in later life. The finding of this study is therefore not out of place.

The findings of this study revealed moderate social adaptation among school-aged children indicating that the children might not possess the optimal social adaptation skills. This can be due to the interpersonal relationship they have with their classmates and their

parents. Interpersonal relationships and coping skills amongst others, have been identified as relevant aspects of social adaptation (Racz et al., 2017). A study carried out by Zaar (2021), which contradicts the findings of this work, shows that children in middle childhood have high social adaptation. They are continuously doing things, making plans, having fun, hanging out with friends, and accomplishing things because they are very busy or hardworking. They are experiencing a lot of activity at this time and are learning how they compare to their friends.

In this study, peer relationships had a weak positive relationship with social adaptation. This implies that as the peer relationship status of the respondents is increasing, their social adaptation level increases equally. This indicates that the interaction school-aged children have with their peers might have an impact on their ability to adjustment to the demands, restrictions and morals of the society. According to Rubin (2012), one consequence of regularly finding oneself in the company of another person and either interacting (or not interacting) in particular ways with that person is the development of identifiable social relationships. If interactions do take place between peers, the nature of the relationships that the members of the dyad develop may be influenced by the nature of these interactions. Thus, positive interactions (e.g., helping, caring, sharing interactions) may lead one to think and feel positively about the individual with whom such exchanges have taken place, be

attracted to that person and look to establish a deep, enduring, and beneficial connection with the person. This study by Rubin affirms that peer relationship among school-aged children has an impact on the way they adapt to their social environment.

Conclusion

The study provided insight into the level of interactions among children and their peers, and how it relates to their ability to adjust to their social environments. Most of the children interacted positively with their mates. They exhibited high prosocial behaviours and were less involved in bullying and being victimized by other children. Only very few of them showed problematic peer relationships. The high prosocial behaviour may have contributed to their high level of positive peer relationships. The children also showed a moderate level of social adaptation which varied with their peer relationship status. The more they related well with their peers, the more their ability to adjust to the demands, restrictions and morals of society. Social adaptation of children might therefore be considered a function of their relationship with their peers.

Recommendation

Based on the findings of the study it was recommended that programmes like debates, talk shows, e.t.c. that would foster social interactions amongst school-aged children should be encouraged. This is because such programs that promote peer relations

can invariably increase ones level of social adaptation.

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Factors and Implications of the High Cost of Living on Households in Gwagwalada Area Council, Abuja

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Abstract

Many Nigerian households are going through hardship to acquire the crucially needed necessities of food, clothing, and shelter. This paper investigated the major factors responsible for the high cost of living in the Federal Capital Territory Abuja, Gwagwalada Area Council and their implications on the households. Two specific objectives guided the study. The study adopted a descriptive survey research design. The study sample consisted of 399 out of 157,770 households in Gwagwalada Area Council. "High Cost of Living on Households Questionnaire (HCLHQ)" validated by three experts was used for data collection. The questionnaire was self-administered by the researchers with the help of three trained research assistants within two weeks, with a 75% return rate. The data obtained from the research were coded into Statistical Product and Service Solutions (SPSS, version 25). Frequencies, charts, and percentages were used to present the data. The results revealed that ineffective government economic policies (53.2%) and a hike in petroleum prices (21.3%), were the major factors of the high cost of living in the area. Other minor factors identified include corruption among public and private officials (16.3%) and the global economic crisis (7.6%). The finding also revealed the high crime rate (28.6%), social ills (25.6%), and hunger (25.2%) and the implications of the high cost of living among households in the area. The study recommended among others that to reduce the implications of the high costs of living on households, the government should embark on people-friendly economic policies and direct social support programmes towards reducing the negative impact on households.

Keywords: Implications, cost of living, households, Gwagwalada

Introduction

The high cost of living is a major concern for many individuals and families around the world. It is an issue that affects people of all income levels and can significantly impact

their quality of life. Nigerians are passing through difficult times as the cost of living continues to rise (Chinedu, 2022). The value of the naira is also depreciating daily despite the regulatory agencies' claim

of making efforts to stabilise the economy. Both salary earners and self-employed citizens complain that their earnings rarely meet up with family demands including feeding, health, education and housing. Coupled with the fact that the minimum monthly wage is still about ₦18, 000 (\$44) for workers in most states, with state governments opposing the new minimum wage of ₦30, 000 (\$73) established by the federal government in 2019 (Ray, 2023).

Surveys by Philip et al. (2022) in Kano, Abuja and Lagos, among other cities, showed that the high cost of living is mostly attributed to the skyrocketing prices of food items, energy, transport and other household consumables. A visit to the market in recent times confirms that the cost of food and other household products is on a high trend (Ighakpe, 2023). According to recent data released by the National Bureau of Statistics (NBS, 2022), although the Nigerian headline inflation rate reduced a little to 21.34% in December 2022, compared to the November 2022 headline inflation rate of 21.47%, however, the inflation rate was 5.72% points higher compared to the 15.63% rate recorded in December 2021. The latest rise in inflation was triggered by the increases recorded in the prices of gas, liquid fuel, solid fuel, passenger transport by road, passenger transport by air, garments, cleaning, repair and hire of clothing.

On food inflation, NBS stated that: "The food inflation rate in December 2022 was 23.75% which was 6.38% higher compared to the

17.37% rate recorded in December 2021. The food inflation rise was caused by increases in prices of bread and cereals, food products, potatoes, yams and other tubers; meat, fish, oil, and fat (Philip et al., 2022). Ray (2023) attributed much of the price increase to the insecurity in many parts of Nigeria resulting in farmers' inability to go to their farms for fear of getting killed. The statistical data above simply reveals that the cost of living is rising relentlessly. For many, bread and milk have become a luxury, and three meals a day is a rarity. Many families now eat rice only on festive occasions because of its high cost (Ighakpe, 2023). Transportation, health treatments, and decent accommodation among other amenities are becoming almost impossible for most Nigerians to access because of their high cost. Those who suffer most are the unskilled labourers and unemployed people who are in no position to demand higher incomes to keep up with rising prices.

Highlights of the 2022 Multidimensional Poverty Index survey by NBS and others revealed that 63% of persons (133 million people) living in Nigeria are multidimensionally poor. Not only have living standards in Nigeria been falling at an unprecedented rate for the past two decades but government responses have been tepid and have failed to halt, let alone reverse, the troubling trend (Lanre, 2022). The inflation rate in the country is higher in urban than rural areas. In June 2021 urban inflation was 18.35% year on year (compared to the same month of

the previous year), compared to 17.16% in rural areas (Tosan, 2021). The cost of living in Nigeria is dependent on the state of residence as some states have a lower cost of living where one can easily afford basic needs. However, of the many cities in the country, Lagos and Abuja have received significant global attention based on their high political and economic relevance. These cities rank high on the list of the most expensive cities in the world ahead of prominent cities like Berlin and Barcelona, meanwhile, Nigeria is rated as one of the poorest countries in the world. Additionally, many Nigerians believe that these cities offer a lot of opportunities than other states which is one of the key reasons for the continuous influx of people into the cities (Tosan, 2021). This was a result of the oil boom of the 1970s which improved the conditions of the big cities significantly while also causing the population to explode. Consequently, private investment in amenities and luxuries to meet the needs of foreigners and businesses increased, which eventually spiked costs in the cities thus, resulting in a very high cost of living in the cities.

Abuja officially became Nigeria's capital in 1991, replacing Lagos. Most countries relocated their embassies to Abuja, which is the headquarters of the Economic Community of West African States (ECOWAS) and the regional headquarters of OPEC. The federal capital territory, designed to accommodate a minimum population of about five million, has witnessed a high influx of people; many fleeing the challenges of rural life in various

communities or those seeking greener economic pastures as well as investors. The high influx of people into Abuja has created a surge in the demand for limited resources including housing, food, education, and transportation. According to International Salary Calculator [ISC] (2023), the cost of living for expatriates in Abuja as of April 2023 is high in comparison to most other places in the world. This high cost of living is evident in different sectors of life which include; education, health care, household accommodation, transportation, and groceries among others. Abuja ranked 75.87 as an extreme hardship location among major cities of the world. Abuja is 8.3% more expensive than Houston for groceries, and 129.8% more expensive for household costs than Kuala Lumpur.

The high cost of living impacts several sectors at the moment. Approximately 820 million people globally are faced with hunger, while over two-thirds of the world population is reported to lack essential nutrients, in their diet, thus negatively impacting well-being and life expectancy (Kansiime et al., 2021). The current rising cost of living in Nigeria has also greatly affected household feeding and diet. The total income of a household is inversely proportional to its food expenditure (Babalola & Isitor, 2014). For instance, bread that used to be sold at ₦200 is now sold at ₦350, which shows an increased rate of 150% in the price of bread (United Nations Conference on Trade and Development [UNCTD], 2022). The availability and cost of

housing are not left out (Pettinger, 2022). In the housing sector, costs of property, leases or rents in Nigeria have astronomically increased. Opara (2021) noted that the biggest challenge for most households in megacities like the Federal Capital Territory (FCT) Abuja, Port-Harcourt or Lagos is securing decent and affordable housing. Education is another sector affected by the rising cost of living. The tuition fees in a regular primary school are between ₦30,000 and ₦150,000 per term, while the prices in international schools usually range from ₦500,000 up to ₦3 million per annum. Public schools cost less as the fees can be as low as ₦5,000, however, they are not usually an option for parents who want to give their children the best education possible. Davis (2012) noted that the rising cost of education especially at the tertiary level is alarming. Recently, payment of tuition fees and other charges especially in higher education institutions put huge pressure on parents or household finances (Akinyemi et al., 2012).

The price increase in fuel and the poor condition of access roads to markets and business places have made transport operators all over Nigeria increase the cost of transporting human beings and goods to meet up with their operational and maintenance costs (Abimbola, 2022; Bolaji, 2022). This leads to poor distribution of consumer items all over the country, thus, compelling the traders and food vendors to increase the prices of available consumer products and food items. In addition, Beth and

Daniel (2022) attributed the factors responsible for the high cost of living to include rising energy prices, shortage of goods, shipping/transportation costs, salary/wage increase, climate impact and trade barriers among other things. Udochukwu et al. (2022) reported that food and household product prices have increased due to fundamental shifts in global supply and demand. Abuja residents have expressed concern over the astronomical rise in the cost of living in the FCT. Although some blame the rising cost of living on the increase in fuel pump prices and the continued closure of international borders, others believe the current economic woes are a result of the government's faulty economic policies (Gboyega, 2022).

According to Azubuike and Nwosu (2017), the persistent increase in consumer product prices has led to extensive malnutrition and food insecurity among the poor, low investment due to insecurity and a negative effect on the trade balance. There is also a hike in intracity transport fares and this has affected the cost of commodities. There has been a lack of or breakdown in basic services such as potable water supply, efficient city transport services, affordable housing, adequate nutrition, and security in many Nigerian urban cities. As a result, the rate of burglary, pickpockets, kidnapping and other criminal activities has increased. Despite the government's efforts to tackle the problem through the provision of tons of assorted grains to needy

citizens in 2022, and the approval of the National Food Security Council to address the issue of persistent hikes in food prices (Gboyega, 2022), the overall cost of living are still beyond the reach of many citizens especially in the big cities like Abuja. It appears the crucial factors that are responsible for the high cost of living have not been identified, and hence the issue has not been properly addressed. It is on this note that this study was designed to identify the major factors responsible for the high cost of living for households in Abuja Federal Capital Territory in Gwagwalada Area Council and the attendant implications.

Objectives of the study

The objectives of the investigation were to:

1. ascertain the major factors responsible for the high cost of living among households in Gwagwalada Area Council, Abuja;
2. identify the major implications of the high cost of living for households in the study area.

Methodology

Design of the Study: The study adopted a descriptive cross-sectional survey research design. A cross-sectional study analyses data from a population, or a representative subset, at a specific point in time (Uzoagulu, 2011)

Population for the Study: The population consisted of 157, 770 households in Gwagwalada Area Council of the Federal Capital

Territory, Abuja (National Population Commission, 2006)

Sample Size Determination and Sampling Technique: The sample size of 399 households was used for the study. Sampling was done in multi-stages. The first stage was the random selection of 30% (4 wards) out of the 10 wards that made up the area. This gave a total of 47,331 households. According to Ogunjimi (2010), a sample size of 15% - 30% is considered adequate for a large population. In the second stage, the Taro Yamane formula was applied to select a sample size of 339 households for the study. The third stage involved the systematic selection of every 9th household on the streets until 399 households were obtained in the four wards.

Instrument for Data Collection: A ten-item questionnaire titled "High Cost of Living on Households Questionnaire (HCLHQ)" was used as an instrument for data collection. It was a closed-ended questionnaire. The questionnaire was made up of two sections A and B, with Yes or No response options. Section A elicited information on the major factors responsible for the high cost of living, while Section B investigated the major implications of the high cost of living on households.

Validity and Reliability of the Instrument: The instrument was face and content validated by three experts from the Department of Consumer Sciences, Base University, Abuja. The reliability of the instrument was ascertained using Cronbach's Alpha reliability test, and a coefficient score of 0.76 was

obtained which fell within an acceptable range.

Method of Data Collection: The researchers with the help of three trained research assistants administered the questionnaire to the respondents within a duration of two weeks. The researchers explained their intentions and after the full consent of respondents was secured, the questionnaire was administered. Out of the 399 copies of the questionnaire administered, 301 were returned valid, representing a 75 per cent success return rate.

Statistical Analysis: Data collected were imputed into the Statistical Package for Social Sciences (SPSS) version 25 software. Descriptive statistics were used for data analysis. The frequency counts, charts, and percentages were used to present the data. The responses with percentages of 20% and above were accepted

while the responses with percentages less than 20% were not accepted.

Results

Factors responsible for the High Cost of living among Households in Gwagwalada Area Council, Abuja.

Table 1 revealed the factors responsible for the high cost of living among households in the study area. The majority (53.2%) of the respondents were of the view that ineffective government economic policies were the major factor responsible for the high cost of living among the households. While 21.3% of the respondents identified a hike in petroleum prices as responsible for the high cost of living in the area. The rest of the items; corruption (16.3%), and global economic crisis (7.6%) were not accepted as the major factors responsible for the high cost of living among the households.

Table 1: Percentage Responses on the Major Factors Responsible for the High Cost of Living among the Respondents

Variables	Frequency	Percentage	Remarks
Ineffective government economic policies	160	53.2	Accepted
Hike in petroleum prices	64	21.3	Accepted
Corruption among public and private officials	49	16.3	Not Accepted
Global economic crisis	23	7.6	Not Accepted
No ideas	5	1.7	Not Accepted
Total	301	100	

An overview of the graph in Figure I indicates that the majority (53.2%) of the respondents believed that ineffective government economic policies followed by hikes in

petroleum prices (21.3%) are the most responsible factors for the high cost of living among the households in the Gwagwalada Area Council, Abuja.

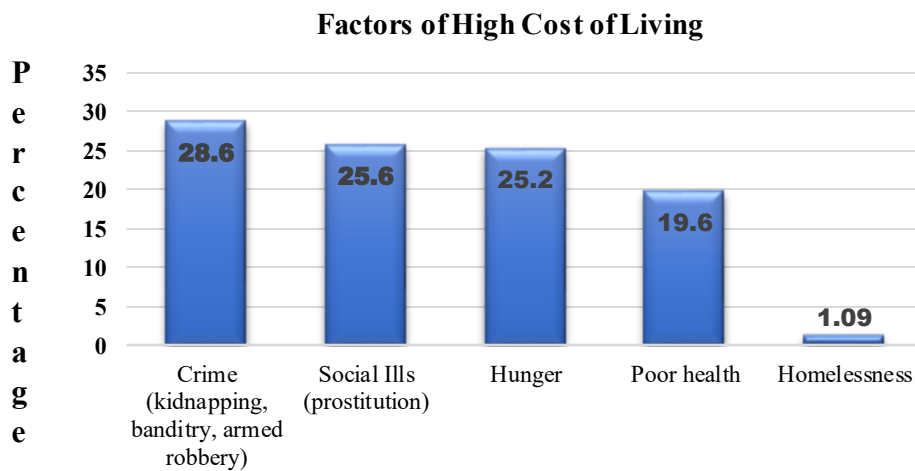


Figure I: Factors responsible for the high cost of living among households

Implications of the high cost of living on households in Gwagwalada Area Council, Abuja

Table 2 revealed the implications of the high cost of living among households in the study area. High incidence of crime (28.6%), prostitution (25.6%) and hunger

(25.2%) were accepted as the implications of the high cost of living among households. Poor health (19.6%) and homelessness (1.09%) were not regarded as the implications of the high cost of living in the study area.

Table 2: Responses on Major Implications of the High Cost of Living among the Respondents

Variables	Frequency	Percentage	Remarks
Crime (kidnapping, banditry, armed robbery)	86	28.6	Accepted
Social Ills (prostitution)	77	25.6	Accepted
Hunger	76	25.2	Accepted
Poor health	59	19.6	Not Accepted
Homelessness	3	1.09	Not Accepted
Total	301	100	

An overview of the graph in Figure II indicates that most of the respondents believed that kidnapping, banditry, armed robbery, etc., and social ills like

prostitution and hunger, were major implications of the high cost of living among households in Gwagwalada Area Council, Abuja.

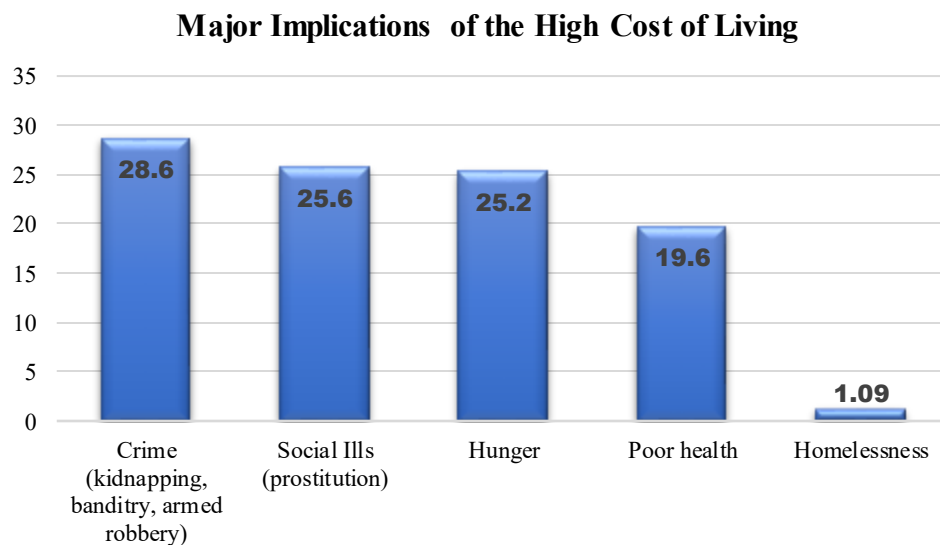


Figure 2: Implications of the high cost of living among households in Gwagwalada Area Council, Abuja

Discussion of Findings

The study identified the major factors responsible for the high cost of living in Gwagwalada Area Council, Abuja metropolis, Nigeria. Ineffective government economic policies and a hike in petroleum prices were the major causes of the high cost of living among households in Gwagwalada Area Council, Abuja identified. These findings are expected since according to Mayowa (2017) the International Monetary Fund (IMF) posits that Nigeria's crisis is not just because of a crash in oil prices, but also because of the delayed and poorly managed policy adjustment to the country's fresh realities. The fund said "inflation has risen to troubling levels" owing to delayed adjustments and the country's foreign exchange policy. Domestic policy failures cited include delayed/poorly managed policy adjustments to lower commodity prices.

The hike in petroleum prices is expected to affect families' cost of living because petroleum marketers are the major determinants of the selling prices irrespective of the official pump prices by the government. Hence, the prices of petroleum vary across various cities in Nigeria. The finding on ineffective government economic policies as a cause of the high cost of living is in line with the finding of Lanre (2022) who found that not only have living standards in Nigeria been falling at an unprecedented rate for the past two decades, but government responses have been tepid and have failed to halt, let alone reverse, the troubling trend of the cost of living of the citizens. However, the findings contradicted the reports by the Nigeria Bureau of Statistics (2022) that reported that the high cost of living in Nigeria is caused by soaring food prices, disruption in the food

supply chain, rise in the cost of imports due to the currency depreciation, and increase in the cost of production. It also contradicted the argument by Pettinger (2022) that the cost of living crisis is fundamentally caused by higher inflation, and low wage growth, leaving many households worse off in real terms. Pettinger (2022) opined that the crisis of cost of living has been exacerbated by short-term factors, such as COVID-19 and the Ukraine war, but the study has shown that the pressure on living standards has long-term trends.

The findings also revealed that implications of the high cost of living among households in Gwagwalada Area Council include the high occurrence of crimes (like kidnapping, banditry, and armed robbery); social ills (prostitution); hunger, and poor health. These results are expected since the National Bureau of Statistics (2022) reported that the Nigerian headline inflation and food inflation are increasing at an alarming rate and the value of naira continues to depreciate even though regulatory agencies claim they are doing everything possible to stabilise the economy. The income of both salary earners and self-employed citizens barely meets up with their family needs including feeding, clothing, shelter, health care, transportation, social welfare and education. Life has therefore become increasingly difficult for many Nigerians, especially the low-income earners, the unemployed, and other vulnerable people as the cost of living keeps rising beyond the reach of the

people. These findings corroborated the results of a study by Kansime et al. (2021) which reported that the high cost of living has huge implications on the diet, health, and well-being of the household. Adequate feeding is a daily necessity and challenge for many households. Approximately 820 million people face the challenge of hunger globally, while more than two-thirds of the world's population does not get essential nutrients from their diet creating negative consequences on the well-being and life expectancy of many households (Kansime et al., 2021). The findings are also in line with the argument by Azubuike and Nwosu (2017) that the rising cost of living has forced some people into crimes (kidnapping, armed robbery, brigandage, advanced fee fraud, etc.) to maintain a decent life. The incidence of killings and kidnappings in Nigeria currently is mostly perpetuated by young people. Many young people live in poor households where parents have little or no financial capacity to provide a reasonable standard of living for their children; so the youths might resort to self-help or use of dishonest means to survive.

Conclusion

The major factors and the negative implications of the high cost of living were revealed in this study. Ineffective government economic policies and a hike in petroleum pump prices were the major factors responsible for the high cost of living among households in Gwagwalada area council, Abuja. Although the issue of corruption and global

economic crisis were to blame, they seemed not to be major complaints of the residents of Abuja metropolis. However, notwithstanding the causes, it is widely believed that the high cost of living in the city is associated with high crime rates such as kidnapping, banditry, and armed robbery, as well as other social ills like prostitution and extreme hunger.

Recommendations

Based on the findings and conclusion of this study, it is recommended that:

1. Government at all levels should quickly embark on people-friendly economic policies and direct social support programmes towards reducing the negative impact of the high cost of living on households; sustenance and survival of households as a priority agenda.
2. Nigerian government should fully deregulate the entire petroleum sector including the production and sale of petroleum motor spirit (PMS) to ensure availability at affordable prices all over the country

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Qualitative and Quantitative Evaluation of Phytochemical Contents of Ogbono and Bitterleaf Soups of Enugu State, Nigeria

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Abstract

The health benefits of phytochemical consumption have been echoed over the years. Being a plant product, sourced specially from vegetables, which are abundant in Africa, there is a likelihood of phytochemicals' presence in African dishes. To affirm or disprove this, the standard protocol was used to assess the qualitative and quantitative evaluation of the phytochemical contents of ogbono and bitterleaf soups of Enugu State, Nigeria. Recipes for these soups were collected from two urban (Nsukka and Ehamufu) and two rural (Obukpa and Neke) communities in Enugu State using Focus Group Discussion (FGD). These recipes were used to prepare the dishes, which were homogenised and screened for alkaloids, tannins, saponins, steroids, terpenoids, glycosides, flavonoids, carotenoids, and phenols. The phytochemicals present were also quantified. Phytates and oxalates were directly quantified (not screened). The Statistical Product and Service Solution (IBM-SPSS, version 22) was used to analyse the data obtained. Only Alkaloid was present in appreciable amounts (+++) in Bitterleaf soup. Glycoside, Terpenoid and Saponin were not detected in both Bitterleaf or Ogbono soups. Ogbono soup had the highest Phenol values (19600mg/100g). The concentration of Phytate was found to be the lowest and of the same values (30mg/100g) in both Bitterleaf and Ogbono soups. Soups contain minimal amounts of phytochemicals which were within tolerable limits, except for Phenol. Therefore, the consumption of these soups is encouraged.

Keywords: Traditional soups, Bitterleaf soup, Ogbono soup,
Phytochemicals, Nigeria

Introduction

Phytochemicals are naturally occurring chemical compounds formed during the plant's normal metabolic processes (Okigbo et al., 2009; Webb, 2013) as primary and secondary metabolite which

functions as a natural defence system for plants. They are largely responsible for the colour, flavour, aroma, and odour of plant foods; blueberries' dark hue, broccoli's bitter taste, and garlic's pungent odour

(Koche et al., 2016; Ugboko et al., 2020; Ugwuona & Uchenna, 2014; Webb, 2013). Phytochemicals are also found naturally in fruits, vegetables, flowers, medicinal plants, leaves, seeds, herbs, and roots. They work synergistically with some plants' nutrients and fibres to prevent the insurgencies of diseases and more accurately guide against disease outbreaks (Akinduro et al., 2017; Okigbo et al., 2009; Olaniyan, 2016). According to Ugwuona and Uchenna (2014), both epidemiological and clinical studies have proven that phytochemicals present in cereals, fruits, and vegetables are mainly responsible for reducing the incidence of chronic and degenerative diseases among populations whose diets are high in these foods. They are health-promoting and disease-preventing. These edible disease fighters (phytochemicals) play a defensive role against major chronic diseases and other health-related complications. As a result, there has been an increased search for phytochemical constituents that possess antioxidant and antimicrobial potency in recent times (Olaniyan, 2016).

The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body (Edeoga et al., 2005). Although mainly found in Africa, which is rich in vegetation, plants, and vegetables, it affirms the study conducted by Beaudry (2013) on the environmental treatment of the impacts of exogenous glucocorticoids on hyperinsulinemia, where he stated that the cure to

almost all diseases in the world can be found in the forests of Africa. Slik et al. (2015) also stated in their work titled 'an estimate of the number of tropical tree species' that Africa has the highest estimated number of tree species with over 15,000 species, compared to other regions such as the Neotropics (Central and South America), which had an estimated 8,000 species.

Most African foods, especially Nigerian foods/soups, are prepared from plant materials that are reported to contain phytochemicals useful to the body (Otuaga et al., 2020). These phytochemicals are isolated from plants and are useful and effective for us in this era (Siddiqui & Moid, 2022). The medicinal properties associated with these plants depend largely on the bioactive phytochemical components of the plants, which have hitherto had several physiological actions on the human body (Akinduro et al., 2017). Phytochemicals, either alone or in combination, have tremendous therapeutic potential in curing various ailments. Epidemiological and animal studies suggest that the regular consumption of fruits, vegetables, and whole grains reduces the risk of chronic diseases associated with oxidative damage (Prakash et al., 2012). Without specific knowledge of their cellular actions or mechanisms, phytochemicals have been considered possible drugs for millennia. For example, Hippocrates may have prescribed willow tree leaves to abate fever. Salicin, having anti-inflammatory and pain-relieving properties, was originally extracted

from the bark of the white willow tree and later synthetically produced to become the staple over-the-counter drug aspirin. Researchers have discovered that beta-carotene is beneficial in the healing of cancer. Carrots have been offering this nutrient for years, but they are only now getting attention. (Olaniyan, 2016). Without a doubt, the cure for almost all diseases in the world can be found in the forests of Africa.

Nigeria, the giant of Africa, has been blessed with a lot of plants and vegetables, from which most mouthwatering delicacies in Nigeria are prepared. According to Edeoga et al. (2005), medicinal plants such as *Cleome Nutidosperma*, *Emilia Coccinea*, *Euphorbia Heterophylla*, *Physalis Angulata*, *Richardia Bransitensis*, *Scopania Dulcis*, *Sida Acuta*, *Spigelia Anthemia*, *Stachytarpheta Cayennensis*, and *Tridax Procumbens*, contain different phytochemicals. Studies have also found phytochemicals in dishes/soups consumed in Nigeria. Various research conducted by Edeoga et al. (2005), Igwenyi & Azoro (2014), Obi & Davidson (2022), and Otuaga et al. (2020) not only detected phytochemicals in soups and their ingredients but also affirmed a tangible amount of phytochemicals in the soups. However, only a few studies have been carried out to detect and quantify phytochemicals in these traditional African soups, mainly consumed in Nigeria. Due to the lack of studies on the phytochemicals present in traditional soups, it has been difficult to state the health benefits of consuming other soups and encourage their

consumption and connection with phytochemicals. This study, therefore, is aimed at providing empirical nutrition data on Ogbono and Bitter leaf soups to add to the body of knowledge on the nutritional benefits of these soups.

Objectives of the study: The general objective of the study was the qualitative and quantitative evaluation of phytochemicals in Ogbono and Bitterleaf soup of eastern Nigeria. Specifically, the study carried out:

1. qualitative analyses of phytochemicals in Ogbono and Bitter leaf soup
2. quantitative analyses of phytochemical Ogbono and Bitter Leaf soup

Materials and methods

Study design: Quasi-experimental study design was adopted in this study.

Procurement of materials: All the ingredients used in preparing the traditional soups were sourced from local markets in both urban and rural communities of Enugu State. Specifically, the ingredients were purchased from Ogige market and Eke Ehamufu in Nsukka and Ehamufu, (urban communities), and Elu-agu market and Ore Neke in Obukpa and Neke (rural communities).

Soup sample preparation: The traditional soup recipes were obtained from a previous study carried out in the Nsukka, Ehamufu, Obukpa, and Neke communities of Enugu State. as detailed below. The

soup preparation was done in the Diet Therapy Laboratory, Home Science and Management Department, University of Nigeria, Nsukka, Enugu State.

Recipe: "Ogbono" soup

Ingredients	Quantity
"Ogbono"	1 cup
Meat	500g
Smoked fish	250g
Crayfish	150g
water	2 litres
Ugba/Okpei (locust bean)	50g
Pepper	25g
Aja-azu (dry fish particles)	300g
Palm oil	1 level cup (milk cup)
Ora/uturukpa	50g
Salt	to taste
Bouillon cubes	4 cubes

Method of Preparation

1. Grind Ogbono separate, Okpei separate, and Crayfish and pepper together.
2. Bring water to a boil, add fish, Crayfish, pepper, bouillon cubes and other ingredients and cover to boil. add vegetables and remove from heat.
3. Place a dry pot on the fire and allow it to dry add Palm oil and Okpei and allow to melt.
4. Add Ogbono and stir together (do not talk or else the Ogbono will not draw)
5. Pour the liquid and turn it till properly mixed.
6. Allow cooking, taste, and stop cooking.

Recipe: Bitter leaf soup

Ingredients	Quantity
Bitter leaves (fresh or dried)	2 wraps
Assorted meat (beef, goat eat, pomo (cow skin), shaki and ideal)	1 kg
Cocoyam ('ede')	3-4 medium size
Crayfish	150g
Water	2 litres
Smoked fish (Optional)	2 pieces
Stockfish (optional)	2-3 pieces
"Ogiri" (fermented locust bean)	1 tablespoon
Palm oil	2 cooking spoons
Ground dry pepper	2 tablespoons
Salt	to taste
Bouillon cubes	4 cubes

Method of preparation:

1. Start by boiling the meat; start with tougher meats like cow leg, and 'shaki' first. When they are slightly tender, add beef or any other softer meat. When all the meats are tender, add the Stockfish, and leave to cook till soft.
2. While the meats are boiling, boil the cocoyam with the skin on. Do not add salt, boil till tender, this should take roughly 20 minutes on medium heat.
3. When they are soft, gently peel the skin off and pound till smooth in a mortar.
4. Wash the bitter leaves with water, boil with enough water for 15 minutes afterwards and then rinse with cold water to get rid of as much bitterness as possible; there should be almost no hint of

- bitterness left in the leaves after washing.
5. When the meat and fish are all soft, add crayfish, and smoked fish, then add the grounded or blended pepper and stir, add palm oil and leave for 3-4 minutes.
 6. Lower the heat, add the blended cocoyam to the stock, and be careful not to add too much. The consistency should be semi-fluid.
 7. The cocoyam will dissolve and thicken the soup; the thickness will depend on preference.
 8. Then add the 'ogiri' and stir, taste for seasoning, and adjust if necessary. Then add the washed bitter leaves and leave to cook for 2-3 minutes. Do not overcook the vegetables.
 9. Serve as desired.

Preparation of samples for chemical analysis: After cooking, the wet soup samples were homogenized, properly packaged, labelled, and taken to the Food and Nutrition Laboratory, Department of Home Science and Management, University of Nigeria, Nsukka, for qualitative and quantitative evaluation of phytochemicals.

Chemical analysis: Quantitative and qualitative evaluation of phytochemicals in all samples was done in duplicate.

Phytochemical screening: Various tests were employed to determine the presence of specific phytochemicals in the samples.

Alkaloid determination: Mayer's test, as described by Ajuru et al. (2017), was conducted. Terpenoids were

detected using a test recommended by Ejikeme et al. (2014). The test for saponin was carried out by shaking the test solution with water and observing the formation of copious lather to indicate the presence of saponins.

Tannin determination: The test solution was mixed with a basic lead acetate solution, and the formation of a white precipitate confirmed the presence of tannins. For glycosides, the extract was boiled with dilute sulfuric acid, followed by the addition of chloroform and shaking. The organic layer was separated, and the gradual addition of ammonia resulted in a pink-to-red colour, indicating the presence of glycosides. For flavonoids, the test solution was mixed with magnesium turning and concentrated hydrochloric acid, then boiled. The appearance of a red or orange colour indicated the presence of flavonoids.

Phenol determination: Phenols were detected by adding ferric chloride solution to the test solution, with a bluish-green colour indicating their presence. Steroids were identified by adding chloroform, acetic anhydride, and concentrated sulfuric acid to the test solution, resulting in a purple colour that changed to blue or green. In the case of carotenoids, 1g of each sample was extracted with 10 ml of chloroform through vigorous shaking. After filtration, 85% sulfuric acid was added, and the presence of carotenoids was confirmed by the appearance of blue colour at the interface.

Quantitative analysis of phytochemicals

Alkaloid determination: Alkaloids content was determined by the alkaline precipitation-gravimetric method described by Harborne (1973).

Oxalate determination: Total oxalate in the sample was assayed using the method of AOAC (199).

Pytate and Tannin determination: Phytate and tannin were determined using the method of AOAC (2010).

Saponin determination: Saponin was determined according to Ochuko and Obadoni's (2001) method.

Flavonoid determination: The Boham and Kocipai method (1994) was used for flavonoid determination.

Phenol determination: The method of analysis of the Analytical Methods Committee of the Royal Society of Chemistry (AMCRS) was used for phenol determination.

Terpenoids determination: To determine terpenoids, about 10g of the sample was taken and soaked in alcohol for 24 hours. It was filtered, and the filtrate was extracted with petroleum ether; this ether extract was treated as total terpenoids.

Glycoside determination: Onwuka (2005) was used to determine glycosides in this study.

Steroid determination: One millilitre (1 ml) of methanolic extract steroid solution was transferred into a 10 ml volumetric flask. Sulphuric acid (4N, 2 ml) and iron (III) chloride (0.5% w/v, 2 ml) were added, followed by potassium hexacyanoferrate (III) solution (0.5% w/v, 0.5 ml). The mixture was heated in a water bath maintained at $70 \pm 2^\circ\text{C}$ for 30 minutes with occasional shaking and diluted

to the mark with dilute water. The absorbance was measured at 780nm against the reagent blank.

Carotenoid determination: A measured weight of each sample was homogenized in methanol using a laboratory blender. A 1:10 (1%) mixture was used. The homogenate was filtrated to take up the carotenoid, mixed well, and then treated with 20 ml of distilled water in a separating funnel. The other layer was recovered and evaporated to dryness at a low temperature ($35 \pm 5^\circ\text{C}$) in a vacuum desiccator. The dry extract was then saponified with 20 ml of ethanoic potassium hydroxide and stored overnight in a dark cupboard. The next day, the carotenoids were taken up in 200 ml of ether and then washed with two portions of 20 ml distilled water. The carotenoid extract (ether layer) was dried in a desiccator and then treated with light petroleum (petroleum spurt) and allowed to stand overnight in a freezer (-10°C). The next day, the precipitate steroid was removed by centrifugation, and the carotenoid extract was evaporated to dryness in a weighed evaporation dish, cooled in a desiccator, and weighed. The weight of the carotenoid was determined and expressed as a percentage of the sample weight.

Statistical analysis: Data obtained was analyzed statistically using Statistical Product for Service Solution (IBM-SPSS), version 22 and presented as Mean \pm Standard deviation.

Results

Qualitative analysis

Table 1 represents the result of the qualitative analysis of phytochemicals in ogbono and bitter-leaf soups. Tannins were detected in moderate amounts in both soups, while saponin, glycosides, and terpenoids were not detected in either

soup. Although flavonoids and phenol were detected in 'Ogbono' soup, they were not detected in Bitter leaf soup. Alkaloid is the only phytochemical present in appreciable amounts in Bitter leaf soup.

Table 1: Qualitative analyses of phytochemicals in the traditional soups

Phytochemicals	Soup Sample	
	"Ogbono" soup	Bitter leaf soup
Tannin	++	++
Phenol	++	-
Flavonoid	++	-
Saponin	-	-
Alkaloid	++	+++
Carotenoid	-	++
Glycoside	-	-
Terpenoid	-	-
Oxalate	++	++
Steroid	-	++

Keys: +++ = present in appreciable amount; ++ = moderately present; + = minimally present; -= not detected.

Table 2 divulges the quantified phytochemicals in both soups. The highest concentration of phenol (19.6) was detected in 'Ogbono soup'. However, certain phytochemicals such as carotenoid, glycoside, terpenoid, steroid, and saponin were

not detected in 'Ogbono soup' when the phytochemicals were quantified. The lowest concentration of the phytochemical – phytate (0.03), was detected in both soup samples. Phytochemicals such as glycosides, terpenoids, and saponins were still not detected in both soups.

Table 2: Phytochemical composition of traditional soups

Phytochemicals	Soup Sample		The tolerable limit for human consumption (mg/100g)
	"Ogbono" soup (mg/100g)	Bitter Leaf Soup (mg/100g)	
Tannin	320	240	2500
Oxalate	330	770	920
Phenol	19600	ND	0.0001
Flavonoid	2970	2770	189700
Phytate	30	30	1000
Alkaloid	3490	3980	-
Carotenoid (mg)	ND	0.29	6
Glycoside	ND	ND	4
Terpenoid	ND	ND	0.1
Steroid	ND	9520	-
Saponin	ND	ND	420

Keys: ND = not detected;

Discussion of findings

The phytochemical screening of the 'Ogbono' soup revealed the presence of tannin, phenol, alkaloid, and flavonoid in moderate amounts but did not detect carotenoids, steroids, glycosides, terpenoids, or saponin. However, there is a disparity between this result and the results of Ezekwe et al., (2021), and Ihenetu et al., (2020) in their study on the Phytochemistry and antioxidant activity of *Irvingia gabonensis* (Bush mango) seed sample and Phytochemical screening, gas chromatography-mass spectroscopy studies and antioxidant property of aqueous extract of Ogbono (*Irvingia gabonensis*) respectively which recorded that tannins, saponins, and steroids were moderately present, flavonoids and alkaloids were minimally present, and terpenoids were not detected. Although there were discrepancies in the presence of the phytochemicals in the studies conducted by Ezekwe et al. (2021) and Ihenetu et al. (2020), the

tannins, terpenoids, flavonoids, and alkaloids that were detected in their study, show a degree of similarity with the results from the current study.

The findings from Don Lawson (2018) on the phytochemical screening of *Irvingia gabonensis* (Ogbono cotyledon) revealed that tannin was present in moderate amounts; alkaloids, flavonoids, glycosides, saponin, and steroids were minimally present, and oxalate and phytate were not detected. In Don Lawson's (2018) study on the phytochemical screening of *Irvingia gabonensis* (Ogbono cotyledon), it was observed that tannin was present in moderate quantities. However, minimal presence was noted for alkaloids, flavonoids, glycosides, saponin, and steroids, while oxalate and phytate were not found. This present study indicated moderate amounts of tannin and did not detect glycosides, saponin, and steroids which corresponds with the findings

of Don Lawson (2018) but detected alkaloids and flavonoids in moderate amounts.

This is not surprising since "ogbono soup" contains other ingredients that might have boosted some phytochemicals in them. Researchers have found that cooking and other methods of food preparation reduce the number of phytochemicals in food, which could be the reason for the reduction and absence of some phytochemicals like glycoside in the soup (Fang et al., 2022; Parlermon et al., 2023; Pellegrini et al., 2010). Another reason could be the processing undergone by the ogbono during its preparation. Sharma et al. (2023) have also reported that fermentation, soaking, roasting, washing, rubbing, and other food processing methods reduce saponin levels in foods and grains.

In the study conducted by Ali et al. (2019), the phytochemical screening and antibacterial activity of the Bitter leaf (*Vernonia amygdalina*) showed the presence of phenol, flavonoids, and saponins. Odukoya et al. (2019) also detected flavonoids, saponins, and terpenoids in the aqueous extract of sun-dried and freeze-dried bitter leaves. However, this contradicts the findings from this study as flavonoids, terpenoids, phenol and saponin were not detected in the bitter leaf soup. The contradictory results may be because Ali et al. (2019) and Odukoya et al. (2019) conducted their studies on the bitter leaf, while the present study screened for phytochemicals in bitter leaf soup. The methods used in processing and cooking the soup

might have led to the loss of the phytochemicals.

The present study detected the presence of tannins, steroids, and alkaloids, which shows a similarity with the study conducted by Usunobun and Okolie (2016), which reported a minimal presence of flavonoids, saponins, tannins, steroids, alkaloids, and glycosides in their study, though differing in the amount present/detected. The present study revealed that alkaloids were present in appreciable amounts, tannin and steroids were present in moderate amounts, and saponin was not detected. The differences in the results could be because Usunobun and Okolie (2016) researched washed bitter leaf, which is the major ingredient of the soup, and not the soup itself. The presence of tannin in Bitter leaf soup could also be from the cocoyam used in its preparation and the bitterness of the bitter leaf. Tannin has an astringent and bitter taste, and the level of tannin in bitter leaves is dependent on the amount of bitterness remaining in the leaves after washing (Anacletus et al., 2015; Azuzu, 2018). Ukong et al. (2014) reported the presence of tannin in cocoyam in appreciable amounts, which could have contributed to the presence of tannin in the soup. The phytochemicals not detected in the soup could be due to the processing and cooking methods. Cooking reduces the amount of glycoside and saponin in food, while preparation and processing of food decrease its flavonoid levels (Yuk et al., 2015). Overall, the present study provides valuable insights into the

phytochemical composition of bitter leaf soup and the potential health benefits it may offer.

According to the study conducted by Usman et al. (2019), the aqueous seed extract of *Irvingia gabonensis* (Ogbono) contains flavonoids (1.05%), glycosides (1.57%), alkaloids (0.07%), and saponins (0.32%). This study reported that Ogbono soup contains flavonoids (2.97%), and alkaloids (3.49%), and did not detect glycoside and saponin. The result of the study conducted by Anaduaka et al. (2022) stated that the aqueous pulp extract of *Irvingia gabonensis* contains phenol (1.23mg), steroid (0.52mg), flavonoid (6.60mg), glycoside (0.40mg), terpenoids (4.68mg), alkaloids (2.26mg), and saponin (0.90 mg). The findings of this study (phenol (19600mg), flavonoid (2970mg), and alkaloid (3490mg). while steroids, glycosides, terpenoids, and saponin were not detected) still contradict the results of the study by Anaduaka et al. (2022). All the detected phytochemicals were within tolerable limits except phenol. Phenol is known to be toxic to human health when in excess, however, this toxicity occurs when it is consumed on its own, (Jewell, 2019), which is hardly the case in soups.

The number of phytochemicals found in the bitter-leaf soup was inconsistent with the results of Ali et al. (2019), who quantified phytochemicals in bitter leaves. According to the result of their study, the bitter leaf contained tannin (1.20%), phenol (3.60%), steroid (4.80%), terpenoids (1.70%), alkaloids (4.60%), flavonoids (12.20%), and

saponin (2.70%). This study recorded tannin (0.24%), alkaloid (3.98%), and flavonoid (2.77%). While phenol and terpenoids were not detected. Again, the findings of Odukoya et al. (2019) recorded finding a total flavonoid of 4.03% from an aqueous extract of sun-dried bitter leaf and 2.14% for a freeze-dried bitter leaf from an ethanolic extract, which also contradicts the concentration of flavonoid (2.77%) in this study. The difference in results could be attributed to various factors, such as the use of different traditional ingredients that are rich in phytochemicals, the processing, preparation, and cooking methods employed in the soup's preparation, and the location from which most of the chief ingredients were sourced (Etsehiwot, 2014; Tiwari & Cummins, 2013; Ukong et al., 2014). It is worth noting that the cooking and food processing methods employed in preparing the soup could have contributed to the reduction in the amount of phytochemicals, especially antinutrients. Atli (2017) previously reported that cooking and food processing methods can reduce the number of phytochemicals present in food.

Conclusion

Nigerian soups, specifically 'Ogbono' and Bitter leaf soups, contain minimal amounts of phytochemicals. Bitter leaf soup contains significantly higher amounts of these phytochemicals compared to 'Ogbono' soup. It is also worth noting that the concentration of phytochemicals in the soups

generally falls within tolerable limits, except for phenol. Therefore, based on these findings, the moderate consumption of these soups should be encouraged.

Recommendations

Based on the findings of this study, the following are recommended;

1. Ogbono soup should be consumed in moderation due to its high concentration of phenol.
2. Bitterleaf soup contains a substantial amount of phytochemicals that are in moderation, it is therefore suggested that its consumption should be encouraged.
3. Further research should be conducted to identify a processing method that could further reduce the level of phenol in ogbono soups and to understand the impact of processing and preparation methods on the optimal retention of phytochemicals in traditional soups.

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Effect of Different Processing Methods (Fermentation and Boiling) on Fatty Acid Profile of Turmeric (*Curcuma Longa*)

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Abstract

The study determined the effect of different processing methods (fermentation and boiling) on the fatty acid profile of turmeric (*Curcuma longa*). Freshly harvested turmeric (2kg), purchased from Gwagwa market, Abuja was washed and divided into three portions (samples A, B and C). Sample A was boiled at 100°C while sample B was fermented for 4 days after which both samples were dried in a hot conventional oven at 55°C for 60 minutes. Samples C which served as the untreated control was also dried. The samples were grounded into a fine powder using a Thomas-Wiley laboratory hammer mill and packed in airtight labelled containers. All the samples were stored at room temperature of 28±2°C. The packed samples were subjected to oil extraction using ethanol as a solvent in a soxhlet extractor. Data were analysed using mean and standard deviation. The results showed that boiled (64.64mg) and fermented (46.24mg) turmeric contains a higher ($p < 0.05$) amount of omega 3 fatty compared to fresh turmeric. The result also showed that boiled and fermented turmeric had higher ($p < 0.05$) fatty acid (0.72mg and 0.56mg) respectively than fresh turmeric (0.42mg). The fresh and boiled turmeric had no significant difference in their unsaturated fatty acid (40.58mg and 40.32mg) content while fermented turmeric had higher ($p < 0.05$) Oleic acid (42.32mg). The study concludes that boiling and fermentation increased the fatty acid profile of turmeric. Therefore, the use of boiled and fermented turmeric should be popularized because of its promising nutritional potential.

Keywords: Processing methods, Turmeric, Fermentation, Boiling, Fatty acid

Introduction

Turmeric is a perennial plant that grows 5 - 6 feet high in the tropical regions of Southern Asia, with trumpet-shaped, dull yellow flowers. Its roots are bulbs that also produce rhizomes, which then produce stems

and roots for new plants (Blumenthal et al., 2000). *Curcuma longa* is a perennial plant with a short stem and large leaves that bears ovate, pyriform, or oblong rhizomes that are brownish-yellow in colour and often branched (Chattopadhyay et al., 2004)

Turmeric is fragrant and has a bitter, somewhat sharp taste. Although it grows in many tropical locations, the majority of turmeric is grown in India, where it is used as a main ingredient in curry (Blumenthal et al., 2000). Turmeric is known as the "Golden spice" as well as the "Spice of life" (Ravindran et al., 2007).

Turmeric (*Curcuma longa*), belongs to the *Zingiberaceae* family and has been traditionally used as a medicinal herb, dietary spice, food source, food preservative, colouring and flavouring agent in many Asian countries (Kim, 2013; Rajkumari & Sanatombi, 2017). Turmeric is a mild digestive and being aromatic, it can serve as a stimulant and a carminative. The active ingredient in turmeric is *curcumin*. As one of nature's most powerful healers, it has been used extensively in the Indian system of medicine as well as Chinese traditional medicine for centuries as an anti-nociceptive, anti-inflammatory, and anti-shock agent (Kim et al., 2016). The activities of turmeric constituents that have been demonstrated include their capabilities to fight against Alzheimer's disease, arthritis, allergies, digestive ailments, depression and cancer (Anantharaman et al., 2014).

Turmeric contains 3–5% volatile oil, which is obtained by steam distillation of turmeric powder, for about 8–10 hours. Turmeric leaves also yield oil which is pale yellow in colour with a peppery and aromatic odour. The oil contains about 60 % turmerone, 25% zingiberene and small quantities of d-phellandrene, d-

sabinene, cineole and forneol (Yu, 2006). Turmeric leaf oil, obtained from the distillation of dry leaves, has applications in the aroma therapy, perfumery, cosmetics and soap industries (Syamkumar, 2008). Antioxidants present in turmeric are recognized for their potential in promoting health and lowering the risk of cancer, hypertension and heart disease (Wolfe & Liu, 2003). The uses of natural antioxidants from plant extract have experienced growing interest due to some human health professionals and consumers' concern about the safety of synthetic antioxidants in foods (Suhaj, 2006). Antioxidant activities in plants have been identified by many researchers (Hinneburg et al., 2006). Curcumin, a powerful antioxidant, is thought to be the most bioactive and calming component of turmeric, with antioxidant, anti-inflammatory, anti-platelet, cholesterol-lowering, anti-bacterial, and anti-fungal properties (Ikpeama et al., 2014).

Nutritionally, turmeric contains 8.92% moisture, 2.85% ash, 4.60% crude fibre, 6.85% fat, 9.40% crude protein and 67.38% carbohydrate (Ikpeama et al., 2014). The function of essential fatty acids (linoleic and alpha-linoleic acid) and their metabolites in human and animal health is a subject of scientific attention today (Shahid et al., 2015). As a result of inadequate omega-3 polyunsaturated fatty acid intake in the human diet, research work has been focused on producing animal and plant food products enriched with a healthy fatty acid profile (Kang, 2008). Total omega-6 fatty

acids were significantly influenced by the inclusion of various antioxidants in omega-3-enriched diets. Antioxidant properties of herbs can stimulate the metabolic pathway of essential fatty acids like omega-3 and omega-6 (Hayat et al., 2010). The antioxidant activity of wild turmeric and fermented wild turmeric was attributed to the presence of phenolic compounds, flavonoid compounds, and volatile oil compounds (Xiong et al., 2017).

Solid-state fermentation (SSF) has gained attention in recent years from biotech industries including in bioremediation; biofuels; the production of lipids, flavours, and aromas for food; and the production of bioactive compounds (Saleh-E-In & Roy, 2007). Solid-state fermentation involves the growth of microorganisms on a solid substrate with a low moisture content (Holker et al., 2004). Fungi are the main group of microorganisms used for solid-state fermentation (Saleh-E-In & Roy, 2007). Solid-state fermentation has several advantages over submerged fermentation including high volumetric productivity, product concentration, simplicity, and low sterilization cost (Jimenez-Quero et al., 2020). Generally, fermentation has been used to improve product properties. The micro-organisms modified the plant constituents during fermentation (Katina et al., 2007a). Many biochemical changes occur during fermentation, leading to alter the bioactivity and digestibility properties of the plant components. Solid-state fermentation (SSF) had been used to increase the phenolic

contents in foods followed by enhancing their antioxidant activity (Katina et al., 2007b).

Turmeric is a liposoluble compound and can be easily dissolved into organic solvents such as methanol, ethanol, and acetone. However, poor water solubility often limits its biomedical uses using aqueous systems (Hettiarachchi et al., 2021). During the isolation and purification of turmeric from oleo resin, the volatile oil present in turmeric solubilizes *curcumin* creating problems in the recrystallization process (Urošević et al., 2022). To eliminate the interference of volatile oil and resolve the problem of recrystallization, the present research work was undertaken. Addressing the problem of food insecurity, several agricultural development institutions were set up and special programmes and projects were launched and fashioned to develop agriculture, reduce rural poverty and earn foreign exchange (Omeje & Ogbu, 2015). However, little or no information is known about the quality characteristics of cooking oil extracted from turmeric. The researchers believe that good knowledge of it will enhance the utilization of the oil in different home and industrial applications as well as its potential to replace palm oils and groundnut oil whose high demand has surged a high market cost.

Furthermore, essential fatty acid insufficiency is a fundamentally problematic model that has likely resulted in greatly overestimating linoleate requirements due to the concurrent absence of dietary alpha-

linolenic. The common "non-essential" fatty acids (palmitate, stearate, and oleate) are more easily replaced in tissue lipids than linoleate and alpha-linolenate, which are also beta-oxidized more quickly. In many cases, more carbon from linoleate and alpha-linolenate is recycled into palmitate and cholesterol than is needed to create long-chain polyunsaturated fatty acids (Cunnane, 2003). These data highlight several issues with the idea of an "essential fatty acid," a word that denotes a fatty acid that is more protected and significant than others that can be produced endogenously. There is undoubtedly a lot more interconnection between the metabolism of essential and non-essential fatty acids than was previously thought. The term "essential fatty acid" could be replaced with more neutral terminology, such as polyunsaturated, omega-3 or omega-6 polyunsaturated, or the specific fatty acid(s) in question, which would increase clarity and possibly encourage more research into the functional and health benefits of polyunsaturated fatty acids (Cunnane, 2003). In addition to the stated problem, there is little information on the quality characteristics of oil extracted from turmeric. Hence, this study aims at extracting turmeric oil and determining the total fatty acid in fresh, boiled and fermented turmeric in order to have a basis for recommending it for culinary use.

Objectives of the study

The broad objective of the study was to determine the effect of different processing methods (fermentation and boiling) on the fatty acid profile of turmeric (*Curcuma longa*). The specific objectives were to;

1. determine the unsaturated fatty acid content of fresh, fermented and boiled turmeric;
2. determine the effect of boiling and fermentation on the fatty acid profile of turmeric; and
3. determine the omega-3 and omega-6 fatty acid contents of boiled, fermented and fresh turmeric.

Scope of the study

Fatty acids can be saturated or unsaturated. However, this study was delimited to the unsaturated fatty acid contents of the turmeric oil produced after boiling and fermentation.

Materials and method

Study design: The study adopted an experimental research design. Experimental design is the process of carrying out research in an objective and controlled fashion so that precision is maximized and specific conclusions can be drawn to establish the effect that a factor has on a dependent variable (Bell, 2009).

Collection of sample materials: Two kilograms of freshly harvested turmeric was purchased from Gwagwa market, Federal Capital Territory, Abuja Nigeria. The plant (turmeric) was taken to the Department of Plant Science and Biotechnology Department, Faculty of Biological Sciences, University of Nigeria Nsukka for identification.

Preparation of samples for chemical analysis:

Two kilograms of turmeric was sorted and washed with clean running water and put in the colander to drain the water. The drained turmeric was peeled and cut into smaller sizes to increase easy grinding. The 2kg turmeric was divided into three equal portions. Sample A was subjected to boiling, sample B was subjected to fermentation and sample C was untreated (raw) and taken as the control. Sample A was boiled at 100°C and dried. Sample B was fermented for four days and dried in a hot conventional oven at 55°C for 60 minutes and dried. All the samples (A, B and C) were ground into a fine powder using a Thomas-Wiley laboratory hammer mill, sieved and packaged in an air-tight transparent plastic container and labelled. The turmeric powders (samples A, B and C) were stored at room temperature (28±2°C).

Extraction of turmeric oil: 2kg fresh turmeric was sorted and washed with clean running water and put in a colander to drain the water. The drained turmeric was peeled and cut in top smaller sizes for easy grinding. The clean dried turmeric was milled using a Thomas- Wiley laboratory hammer mill into a paste. The paste was dissolved in ethanol using soxhlet extractor. The oil extracted from the turmeric was packaged in an airtight container and stored at 28±2°C.

Chemical analysis

Determination of total fat: Total fat was determined using the Kjeldahl

method (AOAC, 2010). A 500ml capacity round bottom flask was filled with 300ml petroleum ether and fixed to the soxhlet extractor. Two grams of sample were placed in a label thimble. The extractor thimble was sealed with cotton wool. The heat was applied to reflux the apparatus for six hours. The thimble was then removed with care. The petroleum ether was removed and dried at 105°C for one hour in an oven. The flask was then cooled in a desiccator and weighed.

$$\% \text{ Fat} = \frac{\text{weight of fat}}{\text{Weight of sample}} \times \frac{100}{1}$$

Determination of the fatty acid profile:

Fatty acid profile was determined by using a gas chromatograph (boiling). The fresh turmeric was washed with clean water and boiled for a duration of 30 minutes in a beaker at 100°C. Turmeric was dried thoroughly and ground. The sample was passed to a 0.1mm sieve and stored in a cool dry container, 5g of the boiled turmeric sample was measured into the conical flask, and 50 ml of ether was added into a conical flask. It was mixed thoroughly and allowed to stand for 30mins, filtered and kept for fatty acid analysis. The fatty acids were analyzed at different columns of the equipment which recorded the quantity of each fatty acid.

The fatty acid profile was determined by using a gas chromatograph (fermentation). Fresh turmeric was washed and soaked in water for 4 days. The soaked turmeric was covered properly for the

fermentation process to take place. After 4 days of fermentation, turmeric was dried and ground. Fermented turmeric was passed to a 0.01mm sieve and stored in a dry container. Then 5g of the fermented turmeric was measured in a conical flask, and 50 ml of ether was added to the conical flask. The mixture was shaken thoroughly to mix, allowed to rest for 30 minutes and filtered.

Determination of omega 3 fatty acid and omega 6 fatty acid: The omega 3 and 6 fatty acids are a class of polyunsaturated fatty acids (PUFAs) characterized by the presence of two or more cis-double bonds, with the position of the first double bond six carbon atoms from the methyl end of the molecules (Mori & Hodgson, 2013). Omega 3 and 6 fatty acids were determined using different spectrophotometers. Methylated turmeric samples are measured at different wavelengths with methanol standard. Omega 3 fatty acid = 520nm. Omega 6 fatty acid = 320nm.

$$\text{Fatty acid} = \frac{\text{wavelength of the standard}}{\text{wavelength of the sample}} \times \frac{100}{1}$$

Statistical analysis: Data obtained was subjected to statistical analysis using the Statistical Product and Service Solution (SPSS) version 23.0. Values were reported as mean, and standard deviation and data were analysed using analysis of variance (ANOVA) for separation of the mean. Duncan's multiple range test was used to determine significant differences between means of variables at a 5% probability level ($p < 0.05$).

Result

Unsaturated fatty acid contents of fresh, fermented and boiled turmeric

Table 1 presented the amount of unsaturated fatty acid in the fresh, boiled and fermented turmeric samples. The result revealed that boiled turmeric had the highest unsaturated fatty acid content (0.72) followed by fermented turmeric (0.56). At $p < 0.05$, there was a significant difference between the fatty acid content of the boiled and fresh turmeric. There was also a significant difference between the fatty acid content of fermented and fresh turmeric.

Table 1: Unsaturated fatty acid contents of fresh, boiled and fermented turmeric (per 100g)

Samples	Unsaturated fatty acid
FT	0.42± 0.01 ^b
BT	0.72 ± 0.01 ^a
FtT	0.56 ± 0.03 ^a

The values are ± Standard Deviation (SD) of triplicate determination. Mean on the same row with different superscript are significantly different at $p < 0.05$. FT= Fresh turmeric; BT= Boiled turmeric; FtT= Fermented turmeric; Mean ± Standard Deviation (SD).

Effect of boiling and fermentation on the fatty acid profile of turmeric

Table 2 shows the effect of boiling and fermentation on the fatty acid profile of turmeric. The result revealed that boiling had no significant effect on oleic acid contents of turmeric. There was higher ($p < 0.05$) palmitic acid (5.63mg) in fresh turmeric than boiled sample (2.15mg). Fresh turmeric also had higher ($p < 0.05$) linoleic (10.63mg) and myristic

(16.15mg) acid than boiled turmeric which had 8.63mg and 4.21mg respectively. Boiled turmeric had higher ($p < 0.05$) ecosenoic (3.44mg) and linolenic (15.64mg) acids than the fresh turmeric. The table also shows that there was significant difference in the unsaturated fatty acid profile of fermented and fresh turmeric. Fermented turmeric had higher ($p < 0.05$) oleic (42.32mg), linoleic (11.29mg) and linolenic (22.48mg) acid than the fresh turmeric which had 40.58mg oleic, 10.63mg linoleic and 10.06mg linolenic acids. The fresh turmeric had higher ($p < 0.05$) palmitic (5.63mg), ecosenoic (2.73mg) and myristic (16.15mg) acid than fermented turmeric.

Table 2: Fatty acid profile of fresh, boiled and fermented turmeric (per 100g)

Unsaturated Fatty Acid	FT	BT	FtT
Oleic acid (mg)	40.58 ± 0.94 ^a	40.32 ± 0.32 ^a	42.32±0.31 ^a
Palmitic acid (mg)	5.63 ± 0.03 ^a	2.15 ± 0.11 ^b	0.01±0.01 ^b
Linoleic acid (mg)	10.63 ± 0.04 ^a	8.63 ± 0.14 ^b	11.29±5.73 ^a
Ecosenoic acid (mg)	2.73 ± 0.04 ^b	3.44 ± 0.03 ^a	1.59±0.13 ^b
Myristic acid (mg)	16.15 ± 0.10 ^a	4.21 ± 0.10 ^b	11.54±0.10 ^b
Linolenic acid (mg)	10.06 ± 0.05 ^b	15.64 ± 0.03 ^a	22.48±0.04 ^a

The values are ± Standard Deviation (SD) of triplicate determination. Mean on the same row with different superscript are significantly different at $p < 0.05$; FT= Fresh turmeric; BT=

Boiled turmeric; FtT= Fermented turmeric; Mean ± Standard Deviation (SD)..

Omega-3 and omega-6 fatty acids contents of boiled, fermented and fresh turmeric

Table 3 shows the omega-3 and omega-6 fatty acids contents of fresh, boiled and fermented turmeric. There was significant ($p < 0.05$) difference between the omega 3 fatty acid of fresh and boiled samples. Boiled turmeric had higher omega 3 fatty acid (64.64mg) than fresh turmeric which had 33.83mg. The quantity of omega 6 fatty acid in fresh turmeric

was 0.24mg while that of boiled turmeric was 0.42mg. The result also showed significant difference ($p < 0.05$) in the quantities of omega 3 and 6 fatty acids of fresh and fermented turmeric. The fermented turmeric had higher ($p < 0.05$) omega 3 (46.84mg) fatty acid than the fresh sample (33.83mg). Fermented turmeric had higher omega 6 (0.47mg) than the fresh turmeric (0.24mg).

Table 3: Estimation of the quantity of omega 3 and omega 6 fatty acids on fresh and treated turmeric

Samples	Omega 3	Omega 6
FT	33.83±6.58 ^a	0.24±0.02 ^b
BT	64.64±11.76 ^b	0.42±0.2 ^a
FtT	46.84±24.53 ^a	0.47±0.00 ^a

The values are ± Standard Deviation (SD) of triplicate determination. Mean on the same row with different superscripts are significantly different at $p < 0.05$; FT= Fresh turmeric; BT= Boiled turmeric; FtT= Fermented turmeric; Mean± Standard Deviation (SD).

Discussion

Demand for quality oils and fats is increasing all over the world. To cope with the increasing demand for oils and fats, non-conventional sources are gaining importance. Boiling and fermentation as methods of processing food bring about several changes in the physical characteristic as the well chemical composition of food items. These processing methods according to Srinivasan (2005) change the bioavailability of protein, carbohydrates, vitamins and lipids. Findings showed that boiled and fermented turmeric samples had higher significant quantities of unsaturated fatty acid content compared to the fresh sample. This suggests that boiling and fermenting

turmeric significantly increases its total unsaturated fatty acid content. According to Schweichler (2022), unsaturated fats, which are liquid at room temperature, are considered good fats because they help enhance blood cholesterol levels, alleviate inflammation, stabilize cardiac rhythms, and play a variety of other beneficial roles. This result is in line with the study of Indira et al. (2021) which revealed that the release of essential oil by enzymatic action through the fermentation process of residue was three times greater than the control. Similarly, findings of a study by Cortez et al. (2020) showed that boiling preserved potential health-promoting phenolic compounds and some unsaturated fatty acids in turmeric. A study by

Biandolina et al. (2021) showed that boiling the sample was valuable and beneficial as it resulted in lower levels of less favourable fatty acids in addition to improving the favourable fatty acids.

The study revealed that fermenting and boiling had no significant effect on the oleic acid content of turmeric even though fermented turmeric had higher oleic acid. This implies that although fermenting turmeric increases its oleic acid contents, the increase was not significant. According to Charalampopoulos et al. (2002), fermentation is a process which is influenced by the activities of microorganisms and enzymes. The findings of this present study showed that oleic acid was the major fatty acid found in the turmeric oil samples higher than other fatty acids present in the oil samples with a value of 40.58mg. This finding contrast with that of Paula et al. (2011) who reported that turmeric gotten from three different regions in Bangladesh contained higher quantities (58.88mg, 56.24mg and 56.99mg) of oleic acids respectively. The difference in the results may be due to the diverse climate, weather conditions and area in which the samples were collected. Yanishlieva-Maslarova and Heinonen (2001) reported that high oleic acid as contained in the study samples helps to reduce the raised level of total plasma cholesterol without reducing the high-density lipoprotein (HDL) cholesterol level. There was significantly higher palmitic and myristic acid in fresh turmeric than in boiled and

fermented samples. This suggests that processing turmeric by boiling and fermenting reduces its palmitic and myristic acid content. According to Verruck et al. (2019), consuming myristic acid in moderation raises the amounts of long-chain omega-3 fatty acids in plasma phospholipids, which may improve cardiovascular health indicators in humans. Levy (2020) reported that when taken in reasonable quantities, palmitic acid may have benefits such as supporting skin health, acting as an anti-inflammatory, and potentially supporting metabolic health.

Findings further showed that boiling significantly reduced the linoleic content of turmeric while fermentation increased the linoleic content, albeit in a negligible amount. Supporting this, the findings of Cortez et al. (2020) showed that boiling caused the loss of some phenolic compounds such as linoleic acid in turmeric. Linoleic acid is crucial in the preservation of the epidermis' transdermal water barrier, and its deficiency can cause scaly skin lesions and growth retardation, among other problems according to Whelan and Fritsche (2013). Boiling significantly increased the eicosenoic acid content of turmeric while fermentation reduced it, although in a negligible amount. Linolenic acid content of turmeric was significantly increased by boiling and fermentation. Linolenic acid is an essential fatty acid that is mainly derived from plant sources such as nuts and seeds and is used for endogenous synthesis of long-chain omega-6 fatty acids (Chowdhury et

al., 2016). One compound that has been demonstrated to exert neuroprotective, anti-inflammatory, and antidepressant properties is α -linolenic acid (Blondeau, 2015).

Omega-3 and omega-6 fatty acids are two polyunsaturated fatty acids essential for health. They are termed essential because they cannot be manufactured by the body and must be obtained from food (Kaur et al., 2014). Findings showed a significant difference between the omega 3 fatty acid of fresh and boiled turmeric samples. Boiled and fermented turmeric had higher omega-3 and omega-6 fatty acids than the fresh sample. This suggests that the essential fatty acid contents of turmeric will increase significantly when it undergoes processing methods such as boiling and fermentation. Fermentation and boiling methods added value to the omega-3 and omega-6 contents of turmeric oil. That is, higher polyunsaturated fatty acids in turmeric oil were due to the processing methods (fermentation and boiling) applied. This result is in line with that of Saleh-E-In and Roy (2007) who reported that turmeric oil possesses a high proportion of unsaturated fatty acid. Fermentation and boiling methods added value to the omega-3 and omega-6 contents of turmeric oil. That is, higher polyunsaturated fatty acids in turmeric oil were due to the processing methods (fermentation and boiling) applied. This result is in line with that of Saleh-E-In and Roy (2007) who reported that turmeric oil possesses a high proportion of

unsaturated fatty acid. Omega-3 fatty acids have important functions such as improving heart health, supporting mental health, reducing weight and waist size, decreasing liver fat, supporting infant brain development and fighting inflammation. Some omega-6 fatty acids have shown benefits in treating symptoms of chronic disease (Richter, 2023).

Conclusion

The study provided some comparative information on the effect of fermentation and boiling processing methods on the fatty acid profile of turmeric. The study concludes that boiling and fermenting turmeric significantly increases its total unsaturated fatty acid content. Although fermenting turmeric increases its oleic acid contents, the increase was not significant. Processing turmeric by boiling and fermenting results in a marked reduction in its palmitic and myristic acid content. Boiling significantly reduces the linoleic content of turmeric while fermentation increases the linoleic content, albeit in a negligible amount. Boiling significantly increases the eicosenoic acid content of turmeric while fermentation reduces it, although in a negligible amount. Linolenic acid content of turmeric was significantly increased by boiling and fermentation. The amount of essential polyunsaturated fatty acid (omega-3 and omega-6) contents of turmeric increases reasonably when turmeric undergoes processing

methods such as fermentation and boiling.

Recommendations

Based on the present study, the following recommendations were made.

- ❖ The use of turmeric both by boiling and fermentation processing methods should be popularized by nutritionists and dieticians as it improves some fatty acids contained in it. Either method can be recommended depending on the nutritional goals and health conditions of the subject.
- ❖ Further research should be carried out on the proximate composition of fresh, boiled and fermented turmeric.
- ❖ Research regarding the shelf life of turmeric oil should be done to establish its use for different purposes.

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